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Feasibility/Treatability Studies for Removal of Heavy Metals from Training Range Soils at the Grafenwöhr Training Area, Germany

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Feasibility/Treatability Studies for Removal of Heavy Metals from Training Range Soils at the Grafenwöhr Training Area, Germany

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1

Feasibility/Treatability Studies for Removal of Heavy Metals from Training Range Soils at the Grafenwöhr Training Area, Germany

by

R.W. Peters

Abstract

A feasibility/treatability study was performed to investigate the leaching potential of heavy metals (particularly lead) from soils at the Grafenwöhr Training Area (GTA) in Germany. The study included an evaluation of the effectiveness of chelant extraction to remediate the heavy-metal-contaminated soils. Batch shaker tests indicated that ethylenediaminetetraacetic acid (EDTA) (0.01M) was more effective than citric acid (0.01M) at removing cadmium, copper, lead, and zinc. EDTA and citric acid were equally effective in mobilizing chromium and barium from the soil. The batch shaker technique with chelant extraction offers promise as a remediation technique for heavy-metal-contaminated soil at the GTA. Columnar flooding tests conducted as part of the study revealed that deionized water was the least effective leaching solution for mobilization of the heavy metals; the maximum solubilization obtained was 3.72% for cadmium. EDTA (0.05M) achieved the greatest removal of lead (average removal of 17.6%). The difficulty of extraction using deionized water indicates that all of the heavy metals are very tightly bound to the soil; therefore, they are very stable in the GTA soils and do not pose a serious threat to the groundwater system. Columnar flooding probably does not represent a viable remediation technique for in-situ cleanup of heavy-metal-contaminated soils at the GTA.

1 Introduction

Military training exercises over the past several decades at the Grafenwöhr Training Area (GTA) in Germany involved firing a wide range of weapons and weapon systems on a number of firing ranges and target areas. The types of weapons used during these live-fire training exercises ranged from small arms and hand grenades to artillery, tanks, and helicopter gun-ships. One environmental consequence of these firing exercises was the deposition of large quantities of heavy metals, such as lead, copper, zinc, and explosive residue, into the soil. Scientists feared that elevated concentrations of some heavy metals could be incorporated into food webs through uptake by vegetation and that significant quantities of heavy metals could be introduced into the local surface waters and/or leached from the soil into groundwater supplies. This could result in heavy metals being transported to surrounding nonmilitary areas, producing significant adverse environmental impacts for the local population.

The type, degree, and extent of heavy metal and explosive residue contamination from current and past training exercises on the three types of firing ranges and their environs at GTA have already been documented; possible contamination of the local environment by heavy metals introduced into local surface or groundwater supplies was brought up as a potential problem during that study. That part of the investigation is described in a report entitled, *Heavy-Metal Contamination on Training Ranges at the Grafenwöhr Training Area, Germany*, prepared by S.D. Zellmer and J.F. Schneider (1993).

This report evaluates the effectiveness of chelant extraction for remediation of the heavy-metal-laden soils at the GTA and discusses whether heavy metals associated with the various firing ranges have leached into the groundwater system.

2 Background

Three firing ranges were selected for study at GTA:

- Range 122: handgun range
- Range 124: rifle range
- Range 111: hand grenade range

Range 122 includes 10 firing points and a 7-m (23-ft) -high earthen berm located about 55 m (180 ft) from the firing line. The range is used for handgun practice, mainly by military police units. There are nine pop-up targets for each firing point; the first eight at distances ranging from 10 m (32.8 ft) to 30 m (99 ft) and the ninth at 50 m (165 ft) from the firing line. A ditch that runs parallel to the berm between the eighth and ninth targets is designed to remove runoff water from the berm and range. The area around the targets is covered by mowed grass; the ditch and berm are covered by a mixture of grasses and low shrubs. A number of spent slugs are present on the soil surface and on the berm. A tower behind the firing line is used for observation and safety control during firing exercises. The area to both sides and behind the range is forested. The area immediately behind the berm, covered by tall grass and shrub cover, is part of the impact area.

Range 124 is used by combat troops to check the accuracy of their rifle sights before rifle qualification on another range. This range has 10 pads for firing from the prone position and 10 pits for firing from the standing position. The firing pits are located about 5 m (16.4 ft) behind each firing pad. A single, small fixed target is located 25 m (82 ft) in front of each firing pad. The area between the firing pads and the targets is covered by mowed grass. The 3-m (10-ft) -high earthen berm behind the targets generally lacks vegetative cover. No spent slugs were evident on the soil surface or in the berm soil, but a depression (bullet pocket) was observed in the berm behind each target. A shallow depression between the targets and the base of the berm provides drainage, and a tower behind the firing line is used for observation and safety control during range operations. The area directly behind the berm, to the right of the range, is forested; the Range 126 parking lot is to the left.

Range 111 is used to provide combat troops with practical experience in the use of high-explosive hand grenades. This range consists of an open oval area measuring about 50 m (165 ft) by 75 m (245 ft) surrounded by an earthen berm approximately 1 m (3 ft) high. The area inside the berm is barren and level except for a number of craters, up to 1 m in depth, resulting from grenade detonations; some of the deeper craters contain standing water. There are two concrete and two log bunkers along the outer edge of the berm to protect the grenadier and the instructor during training exercises. Several other larger concrete structures in the area are for the protection of troops during training exercises. There is some evidence of fragmentation damage to the signs, structures, and trees outside the berm. The area immediately outside the berm is covered by grass; the surrounding area is forested.

The sample collection protocol is described in the Zellmer and Schneider report (1993). Sampling locations for ranges 122 and 124 were selected to represent different degrees of suspected heavy metal and explosive residue contamination. Sampling locations included berms behind the targets (bullet pockets), other parts of the berm, areas between the firing line and targets, areas behind the firing range and outside the training area, and sediment samples from drainageways in the range. The sampling depths were 0-15 cm (0-6 in.) and 15-30 cm (6-12 in.). A 2.5-cm soil probe was used to collect the samples.

Fourteen surface soil samples were collected within the berm area for range 111. Sampling locations included the bottoms and sides of the grenade craters and the areas between craters. Only surface samples were collected within the berm area because grenade fragments and explosive residues were not expected to penetrate the soil to an appreciable depth. Samples were collected using a stainless steel spoon. Additional samples were collected from the berm and outside the berm to provide background levels of heavy metals in the native soils. These samples were collected from depths of 0-15 cm and 15-30 cm using a soil probe.

Field lead measurements were obtained by using a portable x-ray fluorescence spectrum analyzer at the data collection points. The device, which contains a 0.025-Ci ^{109}Cd sealed source, was calibrated by the manufacturer to measure lead in the soil. The minimum detection limit for lead in soil for this device is approximately 50 mg/kg using the standard 60-s measurement time. A validation standard was used at the beginning of each day, periodically during the day, and at the end of each day to ensure that the instrument was operating properly in the field (see Zellmer and Schneider 1993 for additional information). Field measurements were made using a 60-s time period to collect the spectrum. Data recorded in the x-ray fluorescence analyzer were transferred to a portable computer, and backup copies of the data were made on a computer disk at the end of each work day.

Vegetation was removed from the data collection point without disturbing the soil surface, then a 60-s measurement was obtained from the cleared area. If the surface measurement indicated that lead was present at a concentration above 50 mg/kg (the minimum detection limit), several centimeters of soil were removed, and a second measurement was made on the bottom of the excavation. If this reading also indicated lead above 50 mg/kg, additional soil was excavated and another measurement was made. This process was repeated until a reading below 50 mg/kg was obtained. Throughout the day, multiple readings were taken against validation standards to evaluate the precision of the instrument. These readings, called replicate numbers, were recorded along with the soil readings. The firing range number, transect number (based on a grid laid out by the field team), location on the transect, reading depth, replicate number, and lead concentration of each measurement were recorded in a notebook. More than 200 x-ray fluorescence measurements were made; the majority from range 111 were below the instrument detection limit for lead.

Soil samples from both the initial and primary collections were analyzed in two different laboratories at Argonne National Laboratory (ANL) using several different procedures. The Analytical Chemistry Laboratory (ACL) at ANL used the inductively coupled plasma-atomic emission spectroscopy (ICP-AES) procedure to analyze the samples for the following heavy

metals: barium, cadmium, chromium, cobalt, copper, lead, nickel, tin, and zinc. Samples were also digested by using U.S. Environmental Protection Agency (U.S. EPA) Method 3050A (Acid Digestion of Sediments, Sludges, and Soils), followed by measurement using U.S. EPA Method 6010 for ICP-AES. The analytical laboratory operated by the Reclamation Engineering and Geosciences Section¹ of the Energy Systems Division at ANL analyzed selected soil samples using the Toxicity Characteristic Leaching Procedure (TCLP); this method was used to characterize the samples for barium, cadmium, chromium, copper, lead, tin, and zinc. The TCLP data were used to group samples that had similar heavy metal concentrations to ensure that adequate sample volumes would be available for the batch shaker and continuous columnar extraction experiments.

¹ Currently called Center for Environmental Restoration Systems.

3 Purpose and Approach

The purpose of this phase of the project was two-fold: (1) to investigate the potential of extracting heavy metals from the contaminated soil using chelating agents or deionized water, and (2) to investigate the leaching potential of lead (and other heavy metals) from soil samples obtained from the GTA. The heavy metal of primary interest was lead; other heavy metals of interest included copper, zinc, cadmium, chromium, barium, and iron.

The extraction study was conducted in two phases: first using a screening technique employing batch shaker tests, then following with columnar flooding tests. The batch shaker study provided initial identification of optimal conditions for the columnar flooding study. During the shaker tests, the effectiveness of the chelating agents, either ethylenediaminetetraacetic acid (EDTA) or citric acid, on heavy-metal-contaminated soil was evaluated. Water was used as the leachant in the columnar flooding tests to determine the mobility of the lead (and other heavy metals) in GTA soils. Analyses of the test solutions were performed using atomic absorption spectroscopy (AAS).

4 Experimental Procedures

4.1 Batch Shaker Tests

The analytical procedures used to characterize the soil samples collected from the GTA are listed in Table 1. Table 2 summarizes characteristics of the soils used in this study. The soil characterization indicated that the soil was generally slightly alkaline, had a low organic carbon content (less than 2.2%) and a low cation exchange capacity (CEC), and was generally sandy.

Several batches (approximately 200 g each) of contaminated soil obtained from the GTA were air dried in the hood. After drying, the bulk batch samples were subdivided into nominal 5-g portions and placed in plastic shaker containers (with lids) for testing. A 50-mL chelant solution (either 0.01M EDTA or 0.01M citric acid) was then added. In total, 108 soil samples, plus approximately 25% additional spot replicates, were tested.

Samples were shaken for approximately 3 hours at the low setting on an Eberbach shaker table; this time requirement was determined during a previous study to be adequate to achieve equilibrium (Peters and Shem 1992). Following agitation, the samples were centrifuged in plastic Nalgene centrifuge tubes equipped with snap-on caps, filtered using No. 42 Whatman filter paper, and stored in glass vials maintained at a pH of less than 2 (prepped using ultrapure HNO_3) to await AAS analysis. A sample volume of at least 10 mL was collected for the analysis. The tests were calibrated using AAS standards for lead, cadmium, copper, chromium, zinc, barium, and iron, and performed in accordance with the procedures described in *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association 1992).

The TCLP data from the Zellmer and Schneider report (1993) provided the initial heavy metal concentrations for each soil sample. This information was used to determine which soil samples were to be employed in the tests. The TCLP information was also used in conjunction with the AAS measurements to determine the percentage of heavy metal removal.

Data collected from the batch shaker tests included the following: operating temperature, extractant type and concentration, heavy metals concentration on the soil before treatment (and after treatment — as determined by calculation), heavy metals concentration in the extract solution after treatment, pH of the solution before and after treatment, and batch shaking time.

4.2 Columnar Flooding Tests

Because a columnar flow test involves the use of approximately 300 g of material, various soil samples had to be grouped together in order to obtain a sufficient quantity of sample. TCLP data from the Zellmer and Schneider report (1993) provided the information used for grouping samples to obtain the required sample volume.

TABLE 1 Analytical Procedures/Methods for Determining Physical/Chemical Characteristics of Soil Samples

Soil Parameter	Method
CEC	EPA 9081 Methods of Soil Analysis (Part 8) ¹
Particle Size Characterization:	
Size Gradation—sieving	ASTM D2487-85 ²
Particle Size Analysis (hydrometer)	ASTM D422-63 ²
Particle Size Analysis	USCS ³
Soil pH	EPA 9045 Methods of Soil Analysis (Part 9)
Organic Carbon	Methods of Soil Analysis (Part 29)
Heavy Metals (Pb, Cd, Cu, Cr, Zn, Ba, Fe)	Standard Methods

¹ American Society of Agronomy and Soil Science Society of America 1982.

² American Society for Testing Materials (1987a, 1987b).

³ Particle size classification is in accordance with the Unified Soil Classification System.

TABLE 2 Physical and Chemical Characteristics of Soil Samples¹

Range (R)	Depth (cm)	Soil pH	Organic Carbon (%)	CEC (gmol/kg)	Soil Texture (g/kg)			Textural Class
					Sand	Silt	Clay	
122	0	5.8	1.99	12.43	750	180	70	Sandy Loam
124	15	7.1	2.20	17.57	690	210	100	Sandy Loam
124	7	7.4	0.78	7.47	770	160	70	Sandy Loam
124	0	7.1	1.19	6.23	810	120	70	Loamy Sand
124	60	7.7	0.23	1.69	800	130	70	Loamy Sand
111	0	8.7	0.31	4.85	750	130	120	Sandy Loam
111	10	8.0	0.37	4.69	800	130	70	Loamy Sand
Detection Limits		0.1	0.01	0.05	10	10	10	

¹ Samples analyzed by the Reclamation Engineering and Geosciences Laboratory at ANL.

Aluminum columns with a fixed-glass wall were hand-packed with dry soil from the GTA firing ranges. The soil had been passed through an 850- μ m sieve (American Society for Testing Materials [ASTM] mesh #20) and retained by a 75- μ m sieve (ASTM mesh #200). Soil that passed through the 75- μ m sieve was discarded; the fine soil might otherwise plug the flow through the soil columns. The weight of the soil contained in each soil column was measured and recorded.

The packed soil columns were flooded with deionized water to saturate the soil and the deionized water was nominally adjusted to be in the pH range of 3 to 7 to simulate rainfall conditions.

Solutions were pumped through the columns in an upflow mode using a Cole-Parmer Masterflex pump. The volume of solution necessary to initially saturate the soil was noted; this volume was assumed to approximate one pore volume of liquid in the column. Finally, five pore volumes of deionized water were pumped through the columns.

The resulting leachate was drained, collected, and analyzed by using AAS (after prepping with HNO_3) for lead, cadmium, chromium, copper, iron, and zinc. For the soil portions used in performing the column experiment, the heavy metal concentrations were determined by mass balance calculations. Flushing the deionized water column during the experiment enabled researchers to identify the easily desorbed portion of the lead (and other heavy metals) from the soil and provided an indication of how readily lead could leach into the groundwater supply.

After flushing with deionized water, the contaminated soil columns were flushed with a wash solution (again in an upflow mode). The solution contained one chelant (either EDTA or citric acid) at a concentration of 0.05M. (The chelant solution concentration was increased to 0.05M to improve the efficiency of removal of heavy metals from soils.) Each pore volume of liquid was collected, preserved in acid, stored, and analyzed by AAS using standard procedures. Five to eight pore volumes of chelating agent solution were used for each sample.

The TCLP data available from the Zellmer and Schneider report (1993) provided the initial heavy metal concentrations for each soil sample. This information was used to determine which soil samples were to be used for the tests. The TCLP information was also used in conjunction with the AAS measurements to determine the amount and percentage of heavy metal removal, as a function of pore volume throughput.

Data collected from the columnar flooding tests included the following: columnar solution feed flow rates, operating temperature, extractant type and concentration, pH (before and after treatment), heavy metals removed from the soil (determined by mass balance on the soil and total heavy metals concentration in the eluate solution), pore volume, and efficiency of heavy metals removal from the soil column.

4.3 Leaching Tests

Previously collected data on the local groundwater provided information on contaminants. Table 3 presents the characteristics of the industrial well (well no. 118) and drinking water well (well no. 6) at Grafenwöhr, Germany. As shown, the groundwater is slightly acidic, has a low conductivity, and a low total organic carbon concentration. The drinking water well also showed no major heavy metal contamination (with the possible exception of a higher concentration of manganese, which may be due to natural background levels).

The column flooding experiments with deionized water were used to determine how readily lead and other heavy metals could be leached into the groundwater.

TABLE 3 Characterization of the Industrial Well and Drinking Water Well at Grafenwöhr, Germany¹

Contaminant	Concentration	
	Industrial Water Well No. 118	Drinking Water Well No. 6
Organics (mg/L):		
Dichloromethane	ND ²	ND
trans-1,2-Dichloroethene	ND	ND
cis-1,2-Dichloroethene	ND	ND
Trichloromethane	0.0024	ND
1,2-Dichloroethane	ND	ND
1,1,1-Trichloroethane	ND	ND
1,2,2-Trichloroethane	ND	ND
1,2,3-Trichloroethane	ND	ND
Tetrachloromethane	ND	ND
1,2-Dichloropropane	ND	ND
Trichloroethylene	ND	ND
Tetrachloroethylene	ND	ND
1,1,1,2-Tetrachloroethane	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND
Hexachloroethane	ND	ND
Inorganics (mg/L):		
Iron	0.14	0.02
Manganese	0.01	5.3
Mercury	ND	ND
Chromium	4	ND
Cadmium	0.001	0.008
Nickel	ND	0.01
Lead	0.01	ND
Copper	0.08	ND
Zinc	0.08	0.54
Arsenic	ND	ND
Boron	0.10	0.22
Sodium	2	26
Potassium	4	14
Calcium	5	110
Magnesium	2	28
Anions (mg/L):		
Chloride	5	24
Fluoride	ND	ND
Sulfate	18	190
Phosphate	ND	ND
Cyanide	ND	ND
Nitrate	4	49
Nitrite	0.02	0.02
Ammonium (NH ₄ -N)	0.1	20

TABLE 3 (Cont.)

Contaminant	Concentration	
	Industrial Water Well No. 118	Drinking Water Well No. 6
Other Characteristics (mg/L except as noted):		
pH (dimensionless)	5.27	6.18
Conductivity ($\mu\text{S}/\text{cm}$)	13.0	12.7
Total Organic Carbon	0.4	18
BOD ₅ ³	1.8	5.0
KMnO ₄ Demand ⁴	1.1	37
Total Suspended Solids	6	11
Total Dissolved Solids	25	740
Residue	5	445
Buffer Capacity (mmol/L)	0.15	2.9

¹ Adapted from Dames & Moore International 1992.

² ND = Not Detected.

³ BOD₅ = Biological Oxygen Demand.

⁴ KMnO₄ = Potassium Permanganate.

5 Results and Discussion

5.1 Characterization of Untreated Soil

Several national governments, including the U.S. government, have developed guidelines and/or regulations defining hazardous levels of heavy metals contamination in soils and groundwater. In 1988, the Netherlands published the "Dutch List," which presented three categories of heavy metal concentrations: Category A (Baseline Concentration), Category B (Detailed Investigation Needed), and Category C (Remedial Investigation Needed). As of this date, Germany has not established national standards or cleanup levels for heavy-metal-contaminated soils and groundwater. However, the Bavarian state government has generally adopted the Dutch List as its guidelines for assessing heavy metals contamination. Table 4 lists the three Dutch List concentration category values (soil and groundwater) for heavy metals that were included in this investigation.

Prior to performing the chelant extraction experiment, the untreated soil was characterized using ICP, AAS, and TCLP methods. Results of the ICP and TCLP analyses from the untreated

TABLE 4 Dutch List of Heavy Metals with Category Contamination Levels for Soil and Groundwater

Heavy Metal	Concentration in Soil (mg/kg)			Concentration in Groundwater (mg/L)		
	Category A	Category B	Category C	Category A	Category B	Category C
Arsenic (As)	--	30	50	--	30	100
Barium (Ba)	200	400	2000	50	100	500
Cadmium (Cd)	--	5	20	--	2.5	10
Chromium (Cr)	--	250	800	--	50	200
Cobalt (Co)	20	50	300	20	50	200
Copper (Cu)	--	100	500	--	50	200
Lead (Pb)	--	150	600	--	50	200
Mercury (Hg)	--	2	10	--	0.5	2
Nickel (Ni)	--	100	500	--	50	150
Tin (Sn)	20	50	300	10	30	150
Zinc (Zn)	--	500	3000	--	200	800

Reference: Straatsuitgevrij's-Grevenhage (1988)

Category A: Baseline Concentration

Category B: Detailed Investigation Needed

Category C: Remedial Investigation Needed

contaminated soils are listed in Table 5 for the elements of interest for this investigation phase (lead, copper, cadmium, chromium, barium, and zinc). The Dutch list standards (Categories A, B, and C) are also included in Table 5 for comparison. The numbers marked in boldface exceed Category C standards; underlined numbers exceed Category B standards. Table 5 indicates that the samples exhibit lead, copper, cadmium, and zinc contamination. Tables 6 through 8 summarize the ICP and TCLP results for the untreated soils at GTA.

5.2 Characterization of Soil Treated Using Batch Shaker Chelant Extraction

Results of the AAS analyses of contaminated soils treated using batch shaker chelant extraction (either 0.01M citric acid or 0.01M EDTA) are listed in Table 9 for lead, copper, cadmium, chromium, barium, and zinc. Table 9 also compares chelation results with the Dutch List standards. Numbers marked in boldface exceed Category C standards; underlined numbers exceed Category B standards. The data indicate that the most severe treatment problem involves cadmium contamination; lesser problems are presented by barium and zinc contamination. The residual concentrations were calculated by subtracting the amount of heavy metal contained in the chelant solution after treatment (determined by AAS analyses) from the initial heavy metal concentration of the untreated soil (determined by ICP analyses and listed in Table 5). Because grab samples were used to determine the residual concentrations in the untreated and treated soils, several samples contained higher estimated quantities of heavy metals extracted into the chelant solution than the quantities initially reported to be present in the soil (based upon the ICP results presented in Table 5). For those cases, the residual concentrations were arbitrarily assigned a value of approximately zero (~ 0) mg/kg.

The results presented are for the case of a chelant concentration of 0.01M. Due to limited funding and time constraints, no attempt was made to identify the most effective chelant concentration. Rather, the goal of these studies was to determine whether chelant extraction would offer potential as a cleanup technique. In order to assess this potential, the residual metal concentrations (before and after chelant extraction treatment) were compared. Table 10 presents the results for lead, cadmium, and copper; Table 11 presents the results for chromium, barium, and zinc.

The results listed in Tables 10 and 11 indicate that, while the chelant extraction technique did not reduce heavy metals concentrations to meet all the Dutch List standards, it did reduce the heavy metal concentrations in these soils quite effectively. Very few soils would fall under Class C criteria after treatment. The concentrations of heavy metals in the soils were substantially lower in the chelant-extracted soils than in the untreated soils. The two major heavy metals of concern are cadmium and barium. Treatments for these elements did not effectively reduce concentrations to meet the Dutch List guidelines, although the concentrations were indeed lowered. Again, it should be pointed out that no attempt was made to optimize the concentration of chelant to obtain the maximum removal of heavy metals. The concentration of citric acid and EDTA was maintained at 0.01M. To achieve maximum removal of heavy metals from solution, chelant concentrations in the range of 0.05-0.10M should be investigated.

TABLE 5 ICP and TCLP Results from Characterization of Untreated Soils and Groundwater at the Grafenwöhr Training Area

Sample No.	Concentration (mg/kg)					
	Pb	Cd	Cu	Cr	Ba	Zn
Dutch List Standards						
Soils (mg/kg)						
Category A	--	--	--	--	200	--
Category B	150	5.0	100	250	400	500
Category C	600	20	500	800	2,000	3,000
R124 -S003	7,870	1.2	271	7.5	51.8	77.6
-S004	126,000	<u>7.6</u>	798	5.6	37.	125
-S007	4,800	0.97	6,420	7.2	57.3	700
-S009	13,600	2.1	13,200	10.1	53.7	<u>1,350</u>
-S014	1,800	0.98	29.9	6.6	28.9	105
-S015	684	0.96	35.0	6.0	34.4	39.6
-S016	<u>398</u>	0.99	<u>146</u>	7.9	63.2	48.2
R122 -S017	41.2	0.98	28.6	4.6	63.3	23.8
-S022	123	0.97	57.0	3.0	83.4	30.2
-S026	55.0	0.95	51.1	3.5	48.6	23.0
-S029	31.6	0.97	23.7	5.5	71.6	72.7
-S030	314	1.00	32.6	39.2	97.9	<u>2,120</u>
R111 -S037	112	31.1	<u>276</u>	34.8	97.3	5,680
-S038	<u>152</u>	32.3	<u>370</u>	41.8	115	<u>691</u>
-S039	90.6	94.6	1,560	27.7	94.8	<u>976</u>
-S041	70.1	32.5	<u>364</u>	44.4	164	<u>703</u>
-S044	70.7	73.6	<u>322</u>	25.8	92.0	48.6
-S049	26.0	1.0	11.0	16.3	61.0	--
Dutch List Standards						
Groundwater (mg/L)						
Category A	--	--	--	--	50	--
Category B	50	2.5	50	50	100	200
Category C	200	10.0	200	200	500	800
R124 -S003	<u>194</u>	0.028	--	0.007	0.113	--
-S007	53.4	0.036	--	0.008	0.120	--
-S014	37.7	0.015	--	0.031	0.092	--
R122 -S016	3.62	0.006	--	0.008	0.092	--
-S022	1.92	0.005	--	0.007	0.092	--
-S029	0.06	0.005	--	0.007	0.092	--
R111 -S037	0.25	0.815	--	0.033	0.098	--
-S039	0.53	<u>3.490</u>	--	0.051	0.218	--
-S049	0.06	0.021	--	0.007	0.092	--

Boldface Numbers: Exceed Category C Standards

Underlined Numbers: Exceed Category B Standards

R = Range

S = Soil Sample

TABLE 6 Soil Characterization Results for Pb and Cu at the Grafenwöhr Training Area

Sample No.	Pb Concentration			Cu Concentration		
	Soil		TCLP mg/L ²	Soil		TCLP mg/L ²
	mg/kg ¹	mg/kg ²		mg/kg ¹	mg/kg ²	
R124 -S001		0.50	0.03		0.50	0.03
-S002		0.50	0.03		0.25	0.01
-S003	7,870	4,441.0	246.9	271.0	35.90	1.89
-S004	126,000	13,553.1	753.5	798.0	96.93	5.10
-S005		7,330.2	407.6		44.57	2.35
(dup)		3,532.5	196.4		41.35	2.18
-S006		3,539.7	196.8		23.52	1.24
-S007	4,800	7,213.0	401.0	6,420	80.22	4.22
-S008		4,985.5	277.2		67.84	3.57
(dup)		5,024.6	279.4		67.35	3.55
-S009	13,600	9,010.5	501.0	13,200	72.55	3.82
-S010		7,811.7	434.3		66.85	3.52
(dup)		7,365.7	409.5		81.33	4.28
-S011		10,143.8	564.0		77.99	4.11
-S012		6,353.3	353.2		61.90	3.26
-S013		1,051.3	58.45		8.17	0.43
(dup)		1,193.8	66.37		15.85	0.83
-S014	1,800	1,023.9	56.93	29.9	8.76	0.46
-S015	684.0	254.6	14.16	35.0	3.22	0.17
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R122 -S016	398.0	37.72	2.10	146.0	8.42	0.44
-S017	41.2	0.50	0.03	28.6	0.75	0.04
-S018		0.50	0.03		2.97	0.16
-S019		0.50	0.03		0.25	0.01
-S020		1,778.7	98.89		116.4	6.13
-S021		254.6	14.16		9.66	0.51
(dup)		61.70	3.43		6.44	0.34
-S022	123.0	20.16	1.12	57.0	7.68	0.40
-S023		0.50	0.03		1.49	0.08
-S024		350.4	19.48		42.09	2.22
(dup)		332.2	18.47		43.08	2.27
-S025		6.29	0.35		2.73	0.14
-S026	55.0	0.50	0.03	51.1	4.46	0.23
-S027		0.50	0.03		1.49	0.08
(dup)		0.50	0.03		1.49	0.08
-S028		0.50	0.03		0.25	0.01
-S029	31.6	0.50	0.03	23.7	0.25	0.01
-S030	314.0	11.16	0.62	32.6	1.20	0.06

TABLE 6 (Cont.)

Sample No.	Pb Concentration			Cu Concentration		
	Soil		TCLP mg/L ²	Soil		TCLP mg/L ²
	mg/kg ¹	mg/kg ²		mg/kg ¹	mg/kg ²	
R111 -S031		0.50	0.03		1.49	0.08
-S032		0.50	0.03		4.71	0.25
-S033		1.25	0.07		12.14	0.64
-S034		0.50	0.03		10.65	0.56
-S035		5.98	0.33		12.94	0.68
-S036		12.45	0.69		30.40	1.60
-S037	112.0	12.45	0.69	276.0	18.93	1.00
-S038	152.0	15.04	0.84	370.0	25.45	1.34
-S039	90.6	15.04	0.84	1,560	73.42	3.87
-S040		22.75	1.26		37.44	1.97
(dup)		25.46	1.42		33.79	1.78
-S041	70.1	2.51	0.14	364.0	14.61	0.77
-S042		0.50	0.03		21.05	1.11
-S043		0.50	0.03		9.16	0.48
-S044	70.7	3.77	0.21	322.0	7.68	0.40
-S045		0.50	0.03		7.68	0.40
(dup)		0.50	0.03		9.41	0.50
-S046		0.50	0.03		4.21	0.22
(dup)		0.50	0.03		3.22	0.17
-S047		15.04	0.84		2.77	0.15
-S048		0.50	0.03		0.99	0.05
(dup)		0.50	0.03		0.99	0.05
-S049	26.0	0.50	0.03	11.0	0.75	0.04

¹ Determined by the Argonne ACL using ICP-AES.

² Determined by the Argonne Reclamation Engineering and Geosciences Laboratory using AAS and TCLP.

Notes: R = Range
S = Soil Sample
dup = duplicate

TABLE 7 Soil Characterization Results for Cd and Cr at the Grafenwöhr Training Area

Sample No.	Cd Concentration			Cr Concentration		
	Soil		TCLP mg/L ²	Soil		TCLP mg/L ²
	mg/kg ¹	mg/kg ²		mg/kg ¹	mg/kg ²	
R124 -S001		0.38	0.02		0.20	0.01
-S002		0.03	0.00		0.20	0.01
-S003	1.2	0.38	0.02	7.5	0.20	0.01
-S004	7.6	0.38	0.02	5.6	0.20	0.01
-S005		0.03	0.00		0.20	0.01
(dup)		0.38	0.02		0.20	0.01
-S006		0.03	0.00		0.20	0.01
-S007	0.97	0.01	0.00	7.2	0.20	0.01
-S008		0.01	0.00		0.20	0.01
(dup)		0.01	0.00		0.20	0.01
-S009	2.1	0.03	0.00	10.1	0.20	0.01
-S010		0.03	0.00		0.20	0.01
(dup)		0.01	0.00		0.20	0.01
-S011		0.03	0.00		0.20	0.01
-S012		0.03	0.00		0.20	0.01
-S013		0.38	0.02		0.20	0.01
(dup)		0.03	0.00		0.20	0.01
-S014	0.98	1.25	0.06	6.6	0.20	0.01
-S015	0.96	0.01	0.00	6.0	0.20	0.01
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R122 -S016	0.99	0.01	0.00	7.9	0.20	0.01
-S017	0.98	0.01	0.00	4.6	0.20	0.01
-S018		0.03	0.00		0.20	0.01
-S019		0.03	0.00		0.20	0.01
-S020		0.01	0.00		0.20	0.01
-S021		0.01	0.00		0.20	0.01
(dup)		0.01	0.00		0.20	0.01
-S022	0.97	0.01	0.00	3.0	0.20	0.01
-S023		0.01	0.00		0.20	0.01
-S024		0.01	0.00		0.20	0.01
(dup)		0.01	0.00		0.20	0.01
-S025		0.01	0.00		0.20	0.01
-S026	0.95	0.01	0.00	3.5	0.20	0.01
-S027		0.01	0.00		0.20	0.01
(dup)		0.01	0.00		0.20	0.01
-S028		0.01	0.00		0.20	0.01
-S029	0.97	0.01	0.00	5.5	0.20	0.01
-S030	1.00	1.61	0.08	39.2	0.20	0.01

TABLE 7 (Cont.)

Sample No.	Cd Concentration			Cr Concentration		
	Soil		TCLP mg/L ²	Soil		TCLP mg/L ²
	mg/kg ¹	mg/kg ²		mg/kg ¹	mg/kg ²	
R111 -S031		1.77	0.09		0.20	0.01
-S032		12.15	0.63		0.20	0.01
-S033		59.92	3.10		0.20	0.01
-S034		54.73	2.83		0.20	0.01
-S035		40.30	2.08		0.20	0.01
-S036		62.79	3.25		0.20	0.01
-S037	31.1	21.68	1.12	34.8	0.43	0.02
-S038	32.3	25.72	1.33	41.8	0.43	0.02
-S039	94.6	79.98	4.14	27.7	0.43	0.02
-S040		41.92	2.17		0.43	0.02
(dup)		42.73	2.21		0.20	0.01
-S041	32.5	50.75	2.62	44.4	0.20	0.01
-S042		17.26	0.89		0.20	0.01
-S043		21.93	1.13		0.20	0.01
-S044	73.6	17.26	0.89	25.8	0.20	0.01
-S045		6.27	0.32		0.20	0.01
(dup)		5.92	0.31		0.20	0.01
-S046		14.57	0.75		0.20	0.01
(dup)		14.57	0.75		0.20	0.01
-S047		6.65	0.34		0.20	0.01
-S048		2.46	0.13		0.20	0.01
(dup)		1.42	0.07		0.20	0.01
-S049	1.0	0.38	0.02	16.3	0.20	0.01

¹ Determined by the Argonne ACL using ICP-AES.

² Determined by the Argonne Reclamation Engineering and Geosciences Laboratory using AAS and TCLP.

Notes: R = Range
S = Soil Sample
dup = duplicate

TABLE 8 Soil Characterization Results for Zn and Ba at the Grafenwöhr Training Area

Sample No.	Zn Concentration			Ba Concentration		
	Soil		TCLP mg/L ²	Soil		TCLP mg/L ²
	mg/kg ¹	mg/kg ²		mg/kg ¹	mg/kg ²	
R124 -S001		0.61	0.03		804.8	36.04
-S002		0.31	0.02		228.4	10.23
-S003	77.6	13.74	0.74	51.8	607.4	27.20
-S004	125.0	23.59	1.27	37.1	369.0	16.52
-S005		9.62	0.52		332.1	14.87
(dup)		9.01	0.48		339.1	15.18
-S006		7.94	0.43		478.7	21.44
-S007	700.0	14.66	0.79	57.3	282.2	12.64
-S008		14.05	0.76		258.3	11.57
(dup)		14.05	0.76		299.2	13.40
-S009	1,350	16.79	0.90	53.7	439.8	19.69
-S010		14.96	0.80		247.3	11.07
(dup)		13.59	0.73		232.4	10.40
-S011		18.93	1.02		460.8	20.63
-S012		11.91	0.64		327.1	14.65
-S013		5.80	0.31		683.2	30.59
(dup)		6.87	0.37		688.1	30.81
-S014	105.0	8.57	0.46	28.9	903.6	40.46
-S015	39.6	1.07	0.05	34.4	34.89	1.56
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R122 -S016	48.2	5.19	0.26	63.2	304.2	13.62
-S017	23.8	0.31	0.02	63.3	59.82	2.68
-S018		1.53	0.08		107.7	4.82
-S019		0.46	0.02		1.98	0.09
-S020		19.39	1.04		0.50	0.02
-S021		2.60	0.14		0.50	0.02
(dup)		2.44	0.12		0.50	0.02
-S022	30.2	2.75	0.14	83.4	9.96	0.45
-S023		0.31	0.02		0.50	0.02
-S024		7.94	0.43		84.76	3.80
(dup)		8.09	0.43		18.93	0.85
-S025		2.44	0.13		0.50	0.02
-S026	23.0	2.60	0.14	48.6	0.50	0.02
-S027		1.38	0.07		0.50	0.02
(dup)		1.07	0.06		0.50	0.02
-S028		0.15	0.01		76.78	3.44
-S029	72.7	0.15	0.01	71.6	78.77	3.53
-S030	2120	1.04	0.06	97.9	1,032.2	46.22

TABLE 8 (Cont.)

Sample No.	Zn Concentration			Ba Concentration		
	Soil		TCLP mg/L ²	Soil		TCLP mg/L ²
	mg/kg ¹	mg/kg ²		mg/kg ¹	mg/kg ²	
R111 -S031		7.63	0.41		361.0	16.17
-S032		103.7	5.57		703.1	31.48
-S033		63.66	3.42		740.0	33.14
-S034		70.53	3.79		708.1	31.71
-S035		121.9	6.10		712.1	31.89
-S036		359.6	17.98		1,062.1	47.56
-S037	5,680	975.7	52.46	97.3	980.4	43.90
-S038	691.0	1,523.4	81.90	115.0	1,050.2	47.03
-S039	976.0	662.1	35.60	94.8	1,032.2	46.22
-S040		220.9	11.88		464.7	20.81
(dup)		209.1	11.24		525.6	23.53
-S041	703.0	193.6	10.41	164.0	728.0	32.60
-S042		94.19	5.06		514.6	23.04
-S043		368.7	19.82		765.9	34.30
-S044	48.6	400.1	21.51	92.0	803.8	35.99
-S045		349.7	18.80		726.0	32.51
(dup)		449.1	24.15		752.0	33.67
-S046		136.8	7.35		686.2	30.72
(dup)		79.68	4.28		696.1	31.17
-S047		567.5	30.51		1,059.2	47.43
-S048		6.41	0.34		76.78	3.44
(dup)		4.73	0.25		71.79	3.21
-S049		1.68	0.09	61.0	19.93	0.89

¹ Determined by the Argonne ACL using ICP-AES.

² Determined by the Argonne Reclamation Engineering and Geosciences Laboratory using AAS and TCLP.

Notes: R = Range
S = Soil Sample
dup = duplicate

TABLE 9 Results of Chelant Extraction Soil Treatment — Batch Studies

Sample No.	Element Concentration (mg/kg)						
	pH	Pb	Cd	Cu	Cr	Ba	Zn
Dutch List Standards Soils (mg/kg)							
Category A	--	--	--	--	--	200	--
Category B	--	150	5	100	250	400	500
Category C	--	600	20	500	800	2,000	3,000
<u>Citric Acid:</u>							
R111 -S037	5.915	9.06	<u>17.27</u>	~0	0.140	203.7	<u>901.6</u>
	6.409	10.20	<u>19.42</u>	~0	0.140	<u>637.1</u>	<u>623.9</u>
	7.698	10.21	<u>21.05</u>	~0	0.139	<u>684.1</u>	<u>780.1</u>
R111 -S038	6.237	8.04	<u>17.83</u>	~0	0.140	118.7	<u>1,381.2</u>
	6.736	12.78	<u>22.04</u>	~0	0.140	<u>531.5</u>	<u>1,478.4</u>
	7.734	12.80	<u>25.09</u>	~0	0.139	<u>665.0</u>	<u>1,345.2</u>
R111 -S039	6.304	10.44	<u>31.63</u>	~0	0.140	338.2	413.4
	6.321	10.47	<u>46.32</u>	~0	0.139	<u>617.7</u>	<u>562.3</u>
	7.421	9.31	<u>62.88</u>	~0	0.139	<u>718.0</u>	<u>568.1</u>
R111 -S041	5.861	~0	3.08	~0	~0	~0	140.9
	6.498	0.26	<u>39.85</u>	~0	~0	<u>490.0</u>	128.5
	7.601	0.28	<u>40.21</u>	~0	~0	<u>534.2</u>	109.1
R111 -S044	6.432	1.51	<u>11.71</u>	~0	~0	118.9	152.9
	6.747	1.51	<u>15.48</u>	~0	~0	<u>498.5</u>	299.6
	7.261	0.28	13.95	~0	~0	347.9	4.82
R111 -S049	3.257	~0	~0	~0	~0	16.16	~0
	5.163	~0	~0	~0	~0	17.67	~0
	7.093	~0	~0	~0	~0	15.70	~0
<u>EDTA:</u>							
R111 -S037	6.715	~0	<u>11.16</u>	~0	0.140	242.6	<u>861.3</u>
	7.113	~0	<u>11.34</u>	~0	0.140	<u>633.1</u>	<u>902.0</u>
	7.229	~0	<u>15.39</u>	~0	0.140	<u>612.7</u>	<u>905.5</u>
R111 -S038	6.884	~0	<u>10.93</u>	~0	0.139	233.2	<u>1,387.0</u>
	6.982	~0	<u>15.11</u>	~0	0.140	<u>597.5</u>	465.1
	7.204	~0	<u>15.04</u>	~0	0.139	<u>797.1</u>	<u>997.0</u>
R111 -S039	6.401	~0	0.48	~0	0.139	46.70	222.6
	6.854	~0	<u>10.79</u>	~0	0.138	<u>550.0</u>	342.5
	7.186	~0	<u>16.66</u>	~0	0.139	<u>627.5</u>	380.5
R111 -S041	6.214	~0	~0	~0	~0	30.63	~0
	6.887	~0	~0	~0	~0	246.0	~0
	7.431	~0	3.02	~0	~0	<u>416.5</u>	~0

TABLE 9 (Cont.)

		Element Concentration (mg/kg)						
Sample No.		pH	Pb	Cd	Cu	Cr	Ba	Zn
<u>EDTA:</u> (Cont.)								
R111 -S044		6.701	~0	2.96	~0	~0	121.0	~0
		7.321	~0	<u>7.79</u>	~0	~0	339.6	29.66
		7.847	~0	<u>9.44</u>	~0	~0	<u>473.8</u>	83.48
R111 -S049		3.183	~0	~0	~0	~0	15.02	~0
		5.076	~0	~0	~0	~0	17.69	~0
		7.101	~0	~0	~0	~0	0.70	~0

Boldface Numbers: Exceed Category C Standards

Underlined Numbers: Exceed Category B Standards

R = Range

S = Soil Sample

TABLE 10 Comparison of Contaminant Concentrations in Treated and Untreated Soils: Pb, Cd, and Cu

Sample No.	pH	Element Concentration (mg/kg)					
		Pb		Cd		Cu	
		Untreated	Treated	Untreated	Treated	Untreated	Treated
Dutch List Standards							
Soils (mg/kg)							
Category A	--	--	--	--	--	--	--
Category B	--	150	150	5	5	100	100
Category C	--	600	600	20	20	500	500

Citric Acid:

R111 -S037	5.915	112	9.06	31.1	<u>17.27</u>	<u>276</u>	~0
	6.409	112	10.20	31.1	<u>19.42</u>	<u>276</u>	~0
	7.698	112	10.21	31.1	<u>21.05</u>	<u>276</u>	~0
R111 -S038	6.237	<u>152</u>	8.04	32.3	<u>17.83</u>	<u>370</u>	~0
	6.736	<u>152</u>	12.78	32.3	<u>22.04</u>	<u>370</u>	~0
	7.734	<u>152</u>	12.80	32.3	<u>25.09</u>	<u>370</u>	~0
R111 -S039	6.304	90.6	10.44	94.6	31.63	1,560	~0
	6.321	90.6	10.47	94.6	46.32	1,560	~0
	7.421	90.6	9.31	94.6	62.88	1,560	~0

TABLE 10 (Cont.)

		Element Concentration (mg/kg)					
		Pb		Cd		Cu	
Sample No.	pH	Untreated	Treated	Untreated	Treated	Untreated	Treated
<u>Citric Acid: (Cont.)</u>							
R111 -S041	5.861	70.1	~0	32.5	3.08	364	~0
	6.498	70.1	0.26	32.5	39.85	364	~0
	7.601	70.1	0.28	32.5	40.21	364	~0
R111 -S044	6.432	70.7	1.51	73.6	11.71	322	~0
	6.747	70.7	1.51	73.6	15.48	322	~0
	7.261	70.7	0.28	73.6	13.95	322	~0
R111 -S049	3.257	26.0	~0	1.0	~0	11.0	~0
	5.163	26.0	~0	1.0	~0	11.0	~0
	7.093	26.0	~0	1.0	~0	11.0	~0
<u>EDTA:</u>							
R111 -S037	6.715	112	~0	31.1	11.16	276	~0
	7.113	112	~0	31.1	11.34	276	~0
	7.229	112	~0	31.1	15.39	276	~0
R111 -S038	6.884	152	~0	32.3	10.93	370	~0
	6.982	152	~0	32.3	15.11	370	~0
	7.204	152	~0	32.3	15.04	370	~0
R111 -S039	6.401	90.6	~0	94.6	0.48	1,560	~0
	6.854	90.6	~0	94.6	10.79	1,560	~0
	7.186	90.6	~0	94.6	16.66	1,560	~0
R111 -S041	6.214	70.1	~0	32.5	~0	364	~0
	6.887	70.1	~0	32.5	~0	364	~0
	7.431	70.1	~0	32.5	3.02	364	~0
R111 -S044	6.701	70.7	~0	73.6	2.96	322	~0
	7.321	70.7	~0	73.6	7.79	322	~0
	7.847	70.7	~0	73.6	9.44	322	~0
R111 -S049	3.183	26.0	~0	1.0	~0	11.0	~0
	5.076	26.0	~0	1.0	~0	11.0	~0
	7.101	26.0	~0	1.0	~0	11.0	~0

Boldface Numbers: Exceed Category C StandardsUnderlined Numbers: Exceed Category B Standards

R = Range

S = Soil Sample

TABLE 11 Comparison of Contaminant Concentrations in Treated and Untreated Soils: Cr, Ba, and Zn

		Element Concentration (mg/kg)					
		Cr		Ba		Zn	
Sample No.	pH	Untreated	Treated	Untreated	Treated	Untreated	Treated
Dutch List Standards Soils (mg/kg)							
Category A	--	--	--	200	200	--	--
Category B	--	250	250	400	400	500	500
Category C	--	800	800	2,000	2,000	3,000	3,000
<u>Citric Acid:</u>							
R111 -S037	5.915	34.8	0.140	97.3	<u>203.7</u>	5,680	<u>901.6</u>
	6.409	34.8	0.140	97.3	<u>637.1</u>	5,680	<u>623.9</u>
	7.698	34.8	0.139	97.3	<u>684.1</u>	5,680	<u>780.1</u>
R111 -S038	6.237	41.8	0.140	115	118.7	<u>691</u>	<u>1,381.0</u>
	6.736	41.8	0.140	115	<u>531.5</u>	<u>691</u>	<u>1,478.2</u>
	7.734	41.8	0.139	115	<u>665.0</u>	<u>691</u>	<u>1,345.2</u>
R111 -S039	6.304	27.7	0.140	94.8	<u>338.2</u>	<u>976</u>	413.4
	6.321	27.7	0.139	94.8	<u>617.7</u>	<u>976</u>	<u>562.3</u>
	7.421	27.7	0.139	94.8	<u>718.0</u>	<u>976</u>	<u>568.1</u>
R111 -S041	5.861	44.4	~0	164	~0	<u>703</u>	140.9
	6.498	44.4	~0	164	<u>490.0</u>	<u>703</u>	128.5
	7.601	44.4	~0	164	<u>534.2</u>	<u>703</u>	109.1
R111 -S044	6.432	25.8	~0	92.0	118.9	48.6	152.9
	6.747	25.8	~0	92.0	<u>498.5</u>	48.6	299.6
	7.261	25.8	~0	92.0	<u>347.9</u>	48.6	4.82
R111 -S049	3.257	16.3	~0	61.0	16.16	--	~0
	5.163	16.3	~0	61.0	17.67	--	~0
	7.093	16.3	~0	61.0	15.70	--	~0
<u>EDTA:</u>							
R111 -S037	6.715	34.8	0.140	97.3	<u>242.6</u>	5,680	<u>861.3</u>
	7.113	34.8	0.140	97.3	<u>633.1</u>	5,680	<u>902.0</u>
	7.229	34.8	0.140	97.3	<u>612.7</u>	5,680	<u>905.5</u>
R111 -S038	6.884	41.8	0.139	115	<u>233.2</u>	<u>691</u>	<u>1,387.0</u>
	6.982	41.8	0.140	115	<u>597.5</u>	<u>691</u>	465.1
	7.204	41.8	0.139	115	<u>797.1</u>	<u>691</u>	<u>997.0</u>
R111 -S039	6.401	27.7	0.139	94.8	46.70	<u>976</u>	222.6
	6.854	27.7	0.138	94.8	<u>550.0</u>	<u>976</u>	342.5
	7.186	27.7	0.139	94.8	<u>627.5</u>	<u>976</u>	380.5

TABLE 11 (Cont.)

		Element Concentration (mg/kg)					
		Cr		Ba		Zn	
Sample No.	pH	Untreated	Treated	Untreated	Treated	Untreated	Treated
<u>EDTA: (Cont.)</u>							
R111 -S041	6.214	44.4	~0	164	30.63	<u>703</u>	~0
	6.887	44.4	~0	164	<u>246.0</u>	<u>703</u>	~0
	7.431	44.4	~0	164	416.5	<u>703</u>	~0
R111 -S044	6.701	25.8	~0	92.0	121.0	48.6	~0
	7.321	25.8	~0	92.0	<u>339.6</u>	48.6	29.66
	7.847	25.8	~0	92.0	473.8	48.6	83.48
R111 -S049	3.183	16.3	~0	61.0	15.02	- -	~0
	5.076	16.3	~0	61.0	17.69	- -	~0
	7.101	16.3	~0	61.0	0.70	- -	~0

Boldface Numbers: Exceed Category C Standards

Underlined Numbers: Exceed Category B Standards

R = Range

S = Soil Sample

5.3 Batch Shaker Tests

Figure 1 presents the solubilization data for cadmium and lead extracted into solution by using either 0.01M citric acid or 0.01M EDTA for samples S037, S038, S039, S041, S044, and S049. Figure 2 presents the solubilization data for barium, copper, and zinc extracted by using the same two chelant solutions for the same six samples.² The chelant concentration was held constant at 0.01M during these experiments. The soil tested was collected from the hand grenade range (range R111). Data concerning the individual batch shaker experiments are summarized in Appendix A for each of the heavy metals of interest (barium, cadmium, chromium, copper, iron, lead, and zinc).

Figures 1 and 2 indicate that EDTA was about 10 times more effective than citric acid at mobilizing lead, nearly four times more effective at mobilizing cadmium, nearly five times more effective at mobilizing zinc, and two to ten times more effective at mobilizing copper. EDTA and citric acid were nearly equally effective at removing barium and chromium from the soil. The results presented in Figures 1 and 2 generally indicate that, as the pH is lowered, the solubilization

² Chromium results are not graphically displayed because they exhibited a consistent two-level plot caused by concentrations near the lower limit of detection.

FIGURE 1 Solubilization of Heavy Metals (Cd and Pb) from Contaminated Soil Samples S037, S038, S039, S041, S044, and S049, Using 0.01M Citric Acid and 0.01M EDTA

FIGURE 1 (Cont.)

FIGURE 1 (Cont.)

FIGURE 1 (Cont.)

FIGURE 1 (Cont.)

FIGURE 1 (Cont.)

FIGURE 2 Solubilization of Heavy Metals (Ba, Cu, and Zn) from Contaminated Soil Samples S037, S038, S039, S041, S044, and S049, Using 0.01M Citric Acid and 0.01M EDTA

FIGURE 2 (Cont.)

FIGURE 2 (Cont.)

FIGURE 2 (Cont.)

FIGURE 2 (Cont.)

FIGURE 2 (Cont.)

of the heavy metals increases. The data also indicate the following trends in terms of the solubilization of the heavy metals of interest:

Citric Acid: Ba > Zn > Cu > Cd > Pb > Cr

EDTA: Ba $\approx$ Cu > Zn > Pb > Cd > Cr

The amount of heavy metal solubilized was determined based upon the AAS analyses and the volume of the chelant solution applied to the soil samples in the batch shaker tests. The initial and final concentrations of heavy metals contained in samples from the hand grenade range (R111) are shown in Figures 3 and 4 (for soil samples S037, S038, S039, S041, S044, and S049) for citric acid and EDTA extraction, respectively. The data shown in Figures 3 and 4 (and listed in Appendix A) reveal the following heavy metal mobilization information, over the entire pH range studied:

Analyses	Citric Acid Extraction						EDTA Extraction					
	Pb	Cd	Cr	Cu	Ba	Zn	Pb	Cd	Cr	Cu	Ba	Zn
Maximum Metal Removed, %	100	100	100	100	100	100	100	100	100	100	100	100
Minimum Metal Removed, %	15	2	69	100	11	3	100	22	70	100	11	7
Average Metal Removal, %	57	39	85	100	52	42	100	69	85	100	56	65
Mean Removal at Low pH (pH<6), %	61	56	85	100	75	41	100	81	85	100	77	64
Mean Removal at High pH (pH>7), %	59	14	85	100	47	48	100	54	85	100	36	61

These data confirm the information presented earlier. EDTA extraction generally performed slightly better than citric acid extraction, with average heavy metal removal rates ranging from 56 to 100% for EDTA extraction and 39 to 100% for citric acid extraction. The data shown in Figures 3 and 4 indicate that batch shaker chelant extraction does offer promise as a technique to clean up heavy-metal-contaminated soils. However, the proper chelant concentration needs to be determined from optimization studies to achieve maximum heavy metal removal.

5.4 Columnar Flooding Tests

In the columnar flooding studies, deionized water and chelating agent solution were percolated through the soil columns. As mentioned earlier, five pore volumes of deionized water were first passed through the soil column, then approximately eight pore volumes of chelant

FIGURE 3 Initial and Final Heavy Metals Concentrations from Six Soil Samples as a Function of pH for Batch Chelant Extraction of Pb, Cd, Cr, Cu, Ba, and Zn, Using 0.01M Citric Acid

FIGURE 3 (Cont.)

FIGURE 3 (Cont.)

FIGURE 3 (Cont.)

FIGURE 3 (Cont.)

FIGURE 3 (Cont.)

FIGURE 4 Initial and Final Heavy Metals Concentrations from Six Soil Samples as a Function of pH for Batch Chelant Extraction of Pb, Cd, Cr, Cu, Ba, and Zn, Using 0.01M EDTA

FIGURE 4 (Cont.)

FIGURE 4 (Cont.)

FIGURE 4 (Cont.)

FIGURE 4 (Cont.)

FIGURE 4 (Cont.)

solution (0.05M) were passed through. Because of the limited number of soil samples available, several samples were combined in order to provide the approximately 300 g of soil needed to perform the columnar flow experiment. Results of the columnar flow studies are shown in Figures 5 through 9 for lead, cadmium, copper, iron, and zinc, respectively.³ Results from these experiments are summarized below:

Analyses	Heavy Metal					
	Pb	Cd	Cr	Cu	Fe	Zn
Average Removal, %						
Deionized Water	0.31	3.72	1.60	3.72	0.03	1.69
Citric Acid	4.25	11.1	2.37	8.96	0.39	10.6
EDTA	17.6	13.0	2.80	1.41	0.51	4.87
Removal Range, %	0.0-	0.1-	0.5-	0.0-	0.0-	0.5-
	50.6	34.7	6.6	16.0	0.5	24.0
Most Effective Treatment Method	EDTA	(a)	(a)	CIT	(a)	CIT

Notes: (a) denotes that both EDTA and citric acid (CIT) are equally effective at removing this heavy metal.

Appendix B gives detailed information on the amounts of heavy metals removed.

Appendix C gives detailed information on the percentages of heavy metals removed.

5.5 Leaching Tests

As noted earlier (Table 3), the groundwater in the Grafenwöhr, Germany, area showed no major heavy metal contamination.

Extraction with deionized water indicated that all of the heavy metals are very tightly bound to the soil. The quantity of heavy metals leached into solution was generally less than 1.7% of the total amount of heavy metals contained in the soil sample.

The deionized water extraction results indicate that the heavy metals are very stable in the soils at the GTA and do not represent a serious threat to the groundwater system.

³ Chromium results are not graphically displayed because they exhibited a consistent two-level plot caused by concentrations near the lower limit of detection.

FIGURE 5 Columnar Extraction of Pb from Contaminated Soil, Using 0.05M Citric Acid or 0.05M EDTA

FIGURE 5 (Cont.)

FIGURE 5 (Cont.)

FIGURE 5 (Cont.)

FIGURE 5 (Cont.)

FIGURE 5 (Cont.)

FIGURE 5 (Cont.)

FIGURE 5 (Cont.)

FIGURE 6 Columnar Extraction of Cd from Contaminated Soil, Using 0.05M Citric Acid or 0.05M EDTA

FIGURE 6 (Cont.)

FIGURE 6 (Cont.)

FIGURE 6 (Cont.)

FIGURE 7 Columnar Extraction of Cu from Contaminated Soil, Using 0.05M Citric Acid or 0.05M EDTA

FIGURE 7 (Cont.)

FIGURE 7 (Cont.)

FIGURE 7 (Cont.)

FIGURE 7 (Cont.)

FIGURE 7 (Cont.)

FIGURE 7 (Cont.)

FIGURE 8 Columnar Extraction of Fe from Contaminated Soil, Using 0.05M Citric Acid or 0.05M EDTA

FIGURE 8 (Cont.)

FIGURE 8 (Cont.)

FIGURE 8 (Cont.)

FIGURE 8 (Cont.)

FIGURE 8 (Cont.)

FIGURE 8 (Cont.)

FIGURE 9 Columnar Extraction of Zn from Contaminated Soil, Using 0.05M Citric Acid or 0.05M EDTA

FIGURE 9 (Cont.)

FIGURE 9 (Cont.)

FIGURE 9 (Cont.)

FIGURE 9 (Cont.)

FIGURE 9 (Cont.)

FIGURE 9 (Cont.)

FIGURE 9 (Cont.)

6 Summary and Conclusions

The results of this feasibility/treatability study are indicated below.

Batch Shaker Studies:

- EDTA (0.01M) was more effective than citric acid (0.01M) at removing cadmium, copper, lead, and zinc.
- EDTA (0.01M) and citric acid (0.01M) were equally effective for mobilizing chromium and barium from the soil.
- Heavy metals removal was slightly greater with a pH in the range of 5 to 6 than it was with a pH greater than 7.
- The batch shaker chelant extraction technique offers promise as a remediation technique for on-site cleanup of heavy-metal-contaminated soil at the GTA.

Columnar Flooding Studies:

- Deionized water was the least effective leaching solution used in terms of mobilization of the heavy metals; the maximum solubilization obtained was 3.72% for cadmium.
- Extraction with deionized water indicated that all of the heavy metals tested are very tightly bound to the soil. The quantity of heavy metals leached into solution was generally less than 1.7% of the total amount of heavy metals contained in the soil sample.
- The deionized water extraction results indicated that the heavy metals are very stable in the soils at the GTA and do not represent a serious threat to the groundwater system.
- EDTA (0.05M) treatment resulted in the greatest removal of lead; a maximum removal of 50.6% and an average removal of 17.6% were achieved.
- EDTA (0.05M) treatment was more effective than citric acid (0.05M) or distilled water at removing cadmium, chromium, and iron. The average removal rates in columnar extractions using EDTA (0.05M) were 13% for cadmium, 2.8% for chromium, and 0.5% for iron.

- Citric acid (0.05M) was more effective than either EDTA (0.05M) or deionized water at mobilizing copper and zinc in columnar extractions. The average removal rates using citric acid (0.05M) were 8.96% for copper and 10.59% for zinc.
- The amount of heavy metals mobilized from these soils constitutes a relatively low percentage (typically less than 20%).
- Because of the relatively small percentage of heavy metals mobilized in the columnar flooding chelation extraction study, this technique probably does not offer promise for in-situ remediation of heavy-metal-contaminated soil at the GTA.

7 References

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Appendix A:

**Batch Shaker Experiment Data:
S037, S038, S039, S041, S044, and S049**

Ba Removed by Batch Shaker Method

SAMPLE #	Ba (mg/kg)	Wt. of Soil (g)	Ba in Soil (mg)	Ba (mg/L)	Ba in sample (mg)	% Ba Removed	pH of Sample	Ba Remaining in Soil (mg/kg)
R111-S037-.01 CIT-3	980.36	5.003	4.905	28.230	1.270	26%	5.915	726.442
R111-S037-.01 CIT-3-F	980.36	5.003	4.905	78.890	3.550	72%	5.915	270.776
R111-S037-.01 CIT-3-F/C	980.36	5.003	4.905	86.350	3.886	79%	5.915	203.676
R111-S037-.01 CIT-3-F-DUP	980.36	5.003	4.905	82.010	3.690	75%	5.915	242.713
R111-S037-.01 CIT-5	980.36	5.010	4.912	45.750	2.059	42%	6.409	569.432
R111-S037-.01 CIT-5-F	980.36	5.010	4.912	40.420	1.819	37%	6.409	617.306
R111-S037-.01 CIT-5-F/C	980.36	5.010	4.912	38.220	1.720	35%	6.409	637.067
R111-S037-.01 CIT-5-F-DUP	980.36	5.010	4.912	32.890	1.480	30%	6.409	684.941
R111-S037-.01 CIT-7	980.36	5.036	4.937	41.070	1.848	37%	7.698	613.372
R111-S037-.01 CIT-7-F	980.36	5.036	4.937	30.210	1.359	28%	7.698	710.414
R111-S037-.01 CIT-7-F/C	980.36	5.036	4.937	33.090	1.489	30%	7.698	684.679
R111-S037-.01 CIT-7-F-DUP	980.36	5.036	4.937	26.000	1.170	24%	7.698	748.033
R111-S038-.01 CIT-3	1050.17	5.014	5.266	108.290	4.873	93%	6.237	78.281
R111-S038-.01 CIT-3-F	1050.17	5.014	5.266	102.070	4.593	87%	6.237	134.105
R111-S038-.01 CIT-3-F/C	1050.17	5.014	5.266	124.890	5.620	107%	6.237	-70.702
R111-S038-.01 CIT-3-F-DUP	1050.17	5.014	5.266	103.790	4.671	89%	6.237	118.668
R111-S038-.01 CIT-5	1050.17	5.014	5.266	47.900	2.156	41%	6.736	620.274
R111-S038-.01 CIT-5-F	1050.17	5.014	5.266	54.360	2.446	46%	6.736	562.296
R111-S038-.01 CIT-5-F/C	1050.17	5.014	5.266	57.790	2.601	49%	6.736	531.512
R111-S038-.01 CIT-5-F-DUP	1050.17	5.014	5.266	46.100	2.075	39%	6.736	636.428
R111-S038-.01 CIT-7	1050.17	5.030	5.282	42.600	1.917	36%	7.734	669.057
R111-S038-.01 CIT-7-F	1050.17	5.030	5.282	41.920	1.886	36%	7.734	675.140
R111-S038-.01 CIT-7-F/C	1050.17	5.030	5.282	43.060	1.938	37%	7.734	664.941
R111-S038-.01 CIT-7-F-DUP	1050.17	5.030	5.282	38.230	1.720	33%	7.734	708.152
R111-S039-.01 CIT-3	1032.22	5.008	5.169	70.230	3.160	61%	6.304	401.160
R111-S039-.01 CIT-3-F	1032.22	5.008	5.169	72.400	3.258	63%	6.304	381.661
R111-S039-.01 CIT-3-F/C	1032.22	5.008	5.169	77.240	3.476	67%	6.304	338.170
R111-S039-.01 CIT-3-F-DUP	1032.22	5.008	5.169	70.230	3.160	61%	6.304	401.160
R111-S039-.01 CIT-5	1032.22	5.041	5.203	39.280	1.768	34%	6.321	681.575
R111-S039-.01 CIT-5-F	1032.22	5.041	5.203	41.260	1.857	36%	6.321	663.900
R111-S039-.01 CIT-5-F/C	1032.22	5.041	5.203	46.440	2.090	40%	6.321	617.659
R111-S039-.01 CIT-5-F-DUP	1032.22	5.041	5.203	41.680	1.876	36%	6.321	660.151
R111-S039-.01 CIT-7	1032.22	5.029	5.191	39.640	1.784	34%	7.421	677.517
R111-S039-.01 CIT-7-F	1032.22	5.029	5.191	33.710	1.517	29%	7.421	730.580
R111-S039-.01 CIT-7-F/C	1032.22	5.029	5.191	35.120	1.580	30%	7.421	717.963

Ba Removed by Batch Shaker Method

SAMPLE #	Ba (mg/kg)	Wt. of Soil (g)	Ba in Soil (mg)	Ba (mg/L)	Ba in sample (mg)	% Ba Removed	pH of Sample	Ba Remaining in Soil (mg/kg)
R111-S039-01 CIT-7-F-DUP	1032.22	5.029	5.191	28.510	1.283	25%	7.421	777.110
R111-S041-01 CIT-3	728.04	5.002	3.642	117.530	5.289	145%	5.861	-329.307
R111-S041-01 CIT-3-F	728.04	5.002	3.642	108.940	4.902	135%	5.861	-252.028
R111-S041-01 CIT-3-F/C	728.04	5.002	3.642	124.810	5.616	154%	5.861	-394.801
R111-S041-01 CIT-3-F-DUP	728.04	5.002	3.642	98.780	4.445	122%	5.861	-160.625
R111-S041-01 CIT-5	728.04	5.036	3.666	49.700	2.237	61%	6.498	283.938
R111-S041-01 CIT-5-F	728.04	5.036	3.666	23.780	1.070	29%	6.498	515.550
R111-S041-01 CIT-5-F/C	728.04	5.036	3.666	26.640	1.199	33%	6.498	489.994
R111-S041-01 CIT-5-F-DUP	728.04	5.036	3.666	22.860	1.029	28%	6.498	523.771
R111-S041-01 CIT-7	728.04	5.041	3.670	43.970	1.979	54%	7.601	335.529
R111-S041-01 CIT-7-F	728.04	5.041	3.670	23.250	1.046	29%	7.601	520.492
R111-S041-01 CIT-7-F/C	728.04	5.041	3.670	21.710	0.977	27%	7.601	534.239
R111-S041-01 CIT-7-F-DUP	728.04	5.041	3.670	18.790	0.846	23%	7.601	560.305
R111-S044-01 CIT-3	803.83	5.021	4.036	80.060	3.603	89%	6.432	86.304
R111-S044-01 CIT-3-F	803.83	5.021	4.036	66.520	2.993	74%	6.432	207.654
R111-S044-01 CIT-3-F/C	803.83	5.021	4.036	76.420	3.439	85%	6.432	118.927
R111-S044-01 CIT-3-F-DUP	803.83	5.021	4.036	65.720	2.957	73%	6.432	214.824
R111-S044-01 CIT-5	803.83	5.021	4.036	32.170	1.448	36%	6.747	515.511
R111-S044-01 CIT-5-F	803.83	5.021	4.036	34.910	1.571	39%	6.747	490.954
R111-S044-01 CIT-5-F/C	803.83	5.021	4.036	34.070	1.533	38%	6.747	498.482
R111-S044-01 CIT-5-F-DUP	803.83	5.021	4.036	32.680	1.471	36%	6.747	510.940
R111-S044-01 CIT-7	803.83	5.041	4.052	37.970	1.709	42%	7.261	464.879
R111-S044-01 CIT-7-F	803.83	5.041	4.052	17.190	0.774	19%	7.261	650.378
R111-S044-01 CIT-7-F/C	803.83	5.041	4.052	51.080	2.299	57%	7.261	347.849
R111-S044-01 CIT-7-F-DUP	803.83	5.041	4.052	16.390	0.738	18%	7.261	657.520
R111-S049-01 CIT-3	19.93	5.030	0.100	0.400	0.018	18%	3.257	16.351
R111-S049-01 CIT-3-F	19.93	5.030	0.100	0.260	0.012	12%	3.257	17.604
R111-S049-01 CIT-3-F/C	19.93	5.030	0.100	0.420	0.019	19%	3.257	16.173
R111-S049-01 CIT-3-F-DUP	19.93	5.030	0.100	0.250	0.011	11%	3.257	17.693
R111-S049-01 CIT-5	19.93	5.009	0.100	0.580	0.026	26%	5.163	14.719
R111-S049-01 CIT-5-F	19.93	5.009	0.100	0.250	0.011	11%	5.163	17.684
R111-S049-01 CIT-5-F/C	19.93	5.009	0.100	0.250	0.011	11%	5.163	17.684
R111-S049-01 CIT-5-F-DUP	19.93	5.009	0.100	0.250	0.011	11%	5.163	17.684
R111-S049-01 CIT-7	19.93	5.008	0.100	0.870	0.039	39%	7.093	12.113
R111-S049-01 CIT-7-F	19.93	5.008	0.100	1.330	0.060	60%	7.093	7.979

Ba Removed by Batch Shaker Method

SAMPLE #	Ba (mg/kg)	Wt. of Soil (g)	Ba in Soil (mg)	Ba (mg/L)	Ba in sample (mg)	% Ba Removed	pH of Sample	Ba Remaining in Soil (mg/kg)
R111-S049-.01 CIT-7-F/C	19.93	5.008	0.100	60.920	2.741	2747%	7.093	-527.474
R111-S049-.01 CIT-7-F-DUP	19.93	5.008	0.100	0.470	0.021	21%	7.093	15.707
R111-S037-.01 EDTA-3	980.36	5.008	4.910	96.350	4.336	88%	6.715	114.595
R111-S037-.01 EDTA-3-F	980.36	5.008	4.910	80.030	3.601	73%	6.715	261.241
R111-S037-.01 EDTA-3-F/C	980.36	5.008	4.910	82.100	3.695	75%	6.715	242.640
R111-S037-.01 EDTA-3-F-DUP	980.36	5.008	4.910	77.720	3.497	71%	6.715	281.997
R111-S037-.01 EDTA-5	980.36	5.007	4.909	42.580	1.916	39%	7.113	597.676
R111-S037-.01 EDTA-5-F	980.36	5.007	4.909	39.800	1.791	36%	7.113	622.661
R111-S037-.01 EDTA-5-F/C	980.36	5.007	4.909	38.640	1.739	35%	7.113	633.086
R111-S037-.01 EDTA-5-F-DUP	980.36	5.007	4.909	38.900	1.751	36%	7.113	630.749
R111-S037-.01 EDTA-7	980.36	5.010	4.912	37.700	1.697	35%	7.229	641.737
R111-S037-.01 EDTA-7-F	980.36	5.010	4.912	30.450	1.370	28%	7.229	706.857
R111-S037-.01 EDTA-7-F/C	980.36	5.010	4.912	40.930	1.842	37%	7.229	612.725
R111-S037-.01 EDTA-7-F-DUP	980.36	5.010	4.912	29.940	1.347	27%	7.229	711.438
R111-S038-.01 EDTA-3	1050.17	5.024	5.276	102.020	4.591	87%	6.884	136.376
R111-S038-.01 EDTA-3-F	1050.17	5.024	5.276	91.610	4.122	78%	6.884	229.619
R111-S038-.01 EDTA-3-F/C	1050.17	5.024	5.276	91.210	4.104	78%	6.884	233.201
R111-S038-.01 EDTA-3-F-DUP	1050.17	5.024	5.276	84.030	3.781	72%	6.884	297.513
R111-S038-.01 EDTA-5	1050.17	5.009	5.260	51.090	2.299	44%	6.982	591.186
R111-S038-.01 EDTA-5-F	1050.17	5.009	5.260	49.750	2.239	43%	6.982	603.225
R111-S038-.01 EDTA-5-F/C	1050.17	5.009	5.260	50.390	2.268	43%	6.982	597.475
R111-S038-.01 EDTA-5-F-DUP	1050.17	5.009	5.260	41.950	1.888	36%	6.982	673.298
R111-S038-.01 EDTA-7	1050.17	5.019	5.271	40.960	1.843	35%	7.204	682.926
R111-S038-.01 EDTA-7-F	1050.17	5.019	5.271	35.400	1.593	30%	7.204	732.776
R111-S038-.01 EDTA-7-F/C	1050.17	5.019	5.271	28.230	1.270	24%	7.204	797.062
R111-S038-.01 EDTA-7-F-DUP	1050.17	5.019	5.271	29.880	1.345	26%	7.204	782.268
R111-S039-.01 EDTA-3	1032.22	5.026	5.188	135.550	6.100	118%	6.401	-181.419
R111-S039-.01 EDTA-3-F	1032.22	5.026	5.188	99.610	4.482	86%	6.401	140.368
R111-S039-.01 EDTA-3-F/C	1032.22	5.026	5.188	136.690	6.151	119%	6.401	-191.626
R111-S039-.01 EDTA-3-F-DUP	1032.22	5.026	5.188	110.070	4.953	95%	6.401	46.715
R111-S039-.01 EDTA-5	1032.22	5.041	5.203	57.200	2.574	49%	6.854	521.607
R111-S039-.01 EDTA-5-F	1032.22	5.041	5.203	46.220	2.080	40%	6.854	619.623
R111-S039-.01 EDTA-5-F/C	1032.22	5.041	5.203	54.020	2.431	47%	6.854	549.994
R111-S039-.01 EDTA-5-F-DUP	1032.22	5.041	5.203	46.820	2.107	40%	6.854	614.267
R111-S039-.01 EDTA-7	1032.22	5.031	5.193	35.870	1.614	31%	7.186	711.379

Ba Removed by Batch Shaker Method

SAMPLE #	Ba (mg/kg)	Wt. of Soil (g)	Ba in Soil (mg)	Ba (mg/L)	Ba in sample (mg)	% Ba Removed	pH of Sample	Ba Remaining in Soil (mg/kg)
R111-S039-.01 EDTA-7-F	1032.22	5.031	5.193	46.110	2.075	40%	7.186	619.787
R111-S039-.01 EDTA-7-F/C	1032.22	5.031	5.193	45.250	2.036	39%	7.186	627.479
R111-S039-.01 EDTA-7-F-DUP	1032.22	5.031	5.193	33.930	1.527	29%	7.186	728.732
R111-S041-.01 EDTA-3	728.04	5.031	3.663	82.660	3.720	102%	6.214	-11.316
R111-S041-.01 EDTA-3-F	728.04	5.031	3.663	87.910	3.956	108%	6.214	-58.275
R111-S041-.01 EDTA-3-F/C	728.04	5.031	3.663	85.390	3.843	105%	6.214	-35.735
R111-S041-.01 EDTA-3-F-DUP	728.04	5.031	3.663	77.970	3.509	96%	6.214	30.634
R111-S041-.01 EDTA-5	728.04	5.036	3.666	51.390	2.313	63%	6.887	268.836
R111-S041-.01 EDTA-5-F	728.04	5.036	3.666	52.770	2.375	65%	6.887	256.505
R111-S041-.01 EDTA-5-F/C	728.04	5.036	3.666	53.950	2.428	66%	6.887	245.961
R111-S041-.01 EDTA-5-F-DUP	728.04	5.036	3.666	49.290	2.218	60%	6.887	287.601
R111-S041-.01 EDTA-7	728.04	5.027	3.660	30.090	1.354	37%	7.431	458.685
R111-S041-.01 EDTA-7-F	728.04	5.027	3.660	35.020	1.576	43%	7.431	414.553
R111-S041-.01 EDTA-7-F/C	728.04	5.027	3.660	34.800	1.566	43%	7.431	416.522
R111-S041-.01 EDTA-7-F-DUP	728.04	5.027	3.660	29.200	1.314	36%	7.431	466.651
R111-S044-.01 EDTA-3	803.83	5.036	4.048	71.390	3.213	79%	6.701	165.913
R111-S044-.01 EDTA-3-F	803.83	5.036	4.048	79.820	3.592	89%	6.701	90.585
R111-S044-.01 EDTA-3-F/C	803.83	5.036	4.048	76.420	3.439	85%	6.701	120.967
R111-S044-.01 EDTA-3-F-DUP	803.83	5.036	4.048	77.370	3.482	86%	6.701	112.478
R111-S044-.01 EDTA-5	803.83	5.034	4.046	47.250	2.126	53%	6.321	381.452
R111-S044-.01 EDTA-5-F	803.83	5.034	4.046	59.970	2.699	67%	6.321	267.745
R111-S044-.01 EDTA-5-F/C	803.83	5.034	4.046	51.930	2.337	58%	6.321	339.617
R111-S044-.01 EDTA-5-F-DUP	803.83	5.034	4.046	48.780	2.195	54%	6.321	367.775
R111-S044-.01 EDTA-7	803.83	5.013	4.030	34.660	1.560	39%	7.847	492.699
R111-S044-.01 EDTA-7-F	803.83	5.013	4.030	39.350	1.771	44%	7.847	450.598
R111-S044-.01 EDTA-7-F/C	803.83	5.013	4.030	36.770	1.655	41%	7.847	473.758
R111-S044-.01 EDTA-7-F-DUP	803.83	5.013	4.030	29.810	1.341	33%	7.847	536.236
R111-S049-.01 EDTA-3	19.93	5.041	0.100	0.250	0.011	11%	3.183	17.698
R111-S049-.01 EDTA-3-F	19.93	5.041	0.100	0.260	0.012	12%	3.183	17.609
R111-S049-.01 EDTA-3-F/C	19.93	5.041	0.100	0.550	0.025	25%	3.183	15.020
R111-S049-.01 EDTA-3-F-DUP	19.93	5.041	0.100	0.250	0.011	11%	3.183	17.698
R111-S049-.01 EDTA-5	19.93	5.027	0.100	0.320	0.014	14%	5.076	17.065
R111-S049-.01 EDTA-5-F	19.93	5.027	0.100	0.290	0.013	13%	5.076	17.334
R111-S049-.01 EDTA-5-F/C	19.93	5.027	0.100	0.250	0.011	11%	5.076	17.692
R111-S049-.01 EDTA-5-F-DUP	19.93	5.027	0.100	0.250	0.011	11%	5.076	17.692

Ba Removed by Batch Shaker Method

SAMPLE #	Ba (mg/kg)	Wt. of Soil (g)	Ba in Soil (mg)	Ba (mg/L)	Ba in sample (mg)	% Ba Removed	pH of Sample	Ba Remaining in Soil (mg/kg)
R111-S049-.01 EDTA-7	19.93	5.033	0.100	2.090	0.094	94%	7.101	1.243
R111-S049-.01 EDTA-7-F	19.93	5.033	0.100	2.150	0.097	96%	7.101	0.707
R111-S049-.01 EDTA-7-F/C	19.93	5.033	0.100	3.050	0.137	137%	7.101	-7.340
R111-S049-.01 EDTA-7-F-DUP	19.93	5.033	0.100	1.110	0.050	50%	7.101	10.006

Cd Removed by Batch Shaker Method

SAMPLE #	Cd		Wt. of Soil (g)	Cd in		Cd (mg/L)	Cd in		% Cd Removed	pH of Sample	Cd Remaining in Soil (mg/kg)
	(mg/kg)	(mg/kg)		Soil (mg)	Sample (mg)		Sample (mg)	Sample			
R111-S037-01 CIT-3	21.68		5.003	0.108		0.770	0.035	5.915	32%		14.754
R111-S037-01 CIT-3-F	21.68		5.003	0.108		0.510	0.023	5.915	21%		17.093
R111-S037-01 CIT-3-F/C	21.68		5.003	0.108		0.490	0.022	5.915	20%		17.273
R111-S037-01 CIT-3-F-DUP	21.68		5.003	0.108		0.520	0.023	5.915	22%		17.003
R111-S037-01 CIT-5	21.68		5.010	0.109		0.430	0.019	6.409	18%		17.818
R111-S037-01 CIT-5-F	21.68		5.010	0.109		0.220	0.010	6.409	9%		19.704
R111-S037-01 CIT-5-F/C	21.68		5.010	0.109		0.250	0.011	6.409	10%		19.434
R111-S037-01 CIT-5-F-DUP	21.68		5.010	0.109		0.240	0.011	6.409	10%		19.524
R111-S037-01 CIT-7	21.68		5.036	0.109		0.240	0.011	7.698	10%		19.535
R111-S037-01 CIT-7-F	21.68		5.036	0.109		0.090	0.004	7.698	4%		20.876
R111-S037-01 CIT-7-F/C	21.68		5.036	0.109		0.070	0.003	7.698	3%		21.055
R111-S037-01 CIT-7-F-DUP	21.68		5.036	0.109		0.070	0.003	7.698	3%		21.055
R111-S038-01 CIT-3	25.72		5.014	0.129		1.300	0.059	6.237	45%		14.053
R111-S038-01 CIT-3-F	25.72		5.014	0.129		0.870	0.039	6.237	30%		17.912
R111-S038-01 CIT-3-F/C	25.72		5.014	0.129		0.880	0.040	6.237	31%		17.822
R111-S038-01 CIT-3-F-DUP	25.72		5.014	0.129		0.970	0.044	6.237	34%		17.014
R111-S038-01 CIT-5	25.72		5.014	0.129		0.660	0.030	6.736	23%		19.797
R111-S038-01 CIT-5-F	25.72		5.014	0.129		0.410	0.018	6.736	14%		22.040
R111-S038-01 CIT-5-F/C	25.72		5.014	0.129		0.410	0.018	6.736	14%		22.040
R111-S038-01 CIT-5-F-DUP	25.72		5.014	0.129		0.390	0.018	6.736	14%		22.220
R111-S038-01 CIT-7	25.72		5.030	0.129		0.180	0.008	7.734	6%		24.110
R111-S038-01 CIT-7-F	25.72		5.030	0.129		0.080	0.004	7.734	3%		25.004
R111-S038-01 CIT-7-F/C	25.72		5.030	0.129		0.070	0.003	7.734	2%		25.094
R111-S038-01 CIT-7-F-DUP	25.72		5.030	0.129		0.070	0.003	7.734	2%		25.094
R111-S039-01 CIT-3	79.98		5.008	0.401		7.030	0.316	6.304	79%		16.811
R111-S039-01 CIT-3-F	79.98		5.008	0.401		5.380	0.242	6.304	60%		31.637
R111-S039-01 CIT-3-F/C	79.98		5.008	0.401		5.380	0.242	6.304	60%		31.637
R111-S039-01 CIT-3-F-DUP	79.98		5.008	0.401		5.810	0.261	6.304	65%		27.774
R111-S039-01 CIT-5	79.98		5.041	0.403		5.720	0.257	6.321	64%		28.919
R111-S039-01 CIT-5-F	79.98		5.041	0.403		3.790	0.171	6.321	42%		46.147
R111-S039-01 CIT-5-F/C	79.98		5.041	0.403		3.770	0.170	6.321	42%		46.326
R111-S039-01 CIT-5-F-DUP	79.98		5.041	0.403		4.000	0.180	6.321	45%		44.273
R111-S039-01 CIT-7	79.98		5.029	0.402		4.450	0.200	7.421	50%		40.161
R111-S039-01 CIT-7-F	79.98		5.029	0.402		2.030	0.091	7.421	23%		61.815
R111-S039-01 CIT-7-F/C	79.98		5.029	0.402		1.910	0.086	7.421	21%		62.889

Cd Removed by Batch Shaker Method

SAMPLE #	Cd (mg/kg)	Wt. of Soil (g)	Cd in Soil (mg)	Cd (mg/L)	Cd in Sample (mg)	% Cd Removed	pH of Sample	Cd Remaining in Soil (mg/kg)
R111-S039-.01 CIT-7-F-DUP	79.98	5.029	0.402	2.120	0.095	24%	7.421	61.010
R111-S041-.01 CIT-3	50.75	5.002	0.254	6.600	0.297	117%	5.861	-8.626
R111-S041-.01 CIT-3-F	50.75	5.002	0.254	5.080	0.229	90%	5.861	5.048
R111-S041-.01 CIT-3-F/C	50.75	5.002	0.254	5.300	0.239	94%	5.861	3.069
R111-S041-.01 CIT-3-F-DUP	50.75	5.002	0.254	5.490	0.247	97%	5.861	1.360
R111-S041-.01 CIT-5	50.75	5.036	0.256	3.750	0.169	66%	6.498	17.241
R111-S041-.01 CIT-5-F	50.75	5.036	0.256	1.160	0.052	20%	6.498	40.385
R111-S041-.01 CIT-5-F/C	50.75	5.036	0.256	1.220	0.055	21%	6.498	39.848
R111-S041-.01 CIT-5-F-DUP	50.75	5.036	0.256	1.180	0.053	21%	6.498	40.206
R111-S041-.01 CIT-7	50.75	5.041	0.256	4.260	0.192	75%	7.601	12.722
R111-S041-.01 CIT-7-F	50.75	5.041	0.256	1.280	0.058	23%	7.601	39.324
R111-S041-.01 CIT-7-F/C	50.75	5.041	0.256	1.360	0.061	24%	7.601	38.610
R111-S041-.01 CIT-7-F-DUP	50.75	5.041	0.256	1.190	0.054	21%	7.601	40.127
R111-S044-.01 CIT-3	17.26	5.021	0.087	1.130	0.051	59%	6.432	7.133
R111-S044-.01 CIT-3-F	17.26	5.021	0.087	0.580	0.026	30%	6.432	12.062
R111-S044-.01 CIT-3-F/C	17.26	5.021	0.087	0.620	0.028	32%	6.432	11.703
R111-S044-.01 CIT-3-F-DUP	17.26	5.021	0.087	0.630	0.028	33%	6.432	11.614
R111-S044-.01 CIT-5	17.26	5.021	0.087	0.400	0.018	21%	6.747	13.675
R111-S044-.01 CIT-5-F	17.26	5.021	0.087	0.190	0.009	10%	6.747	15.557
R111-S044-.01 CIT-5-F/C	17.26	5.021	0.087	0.200	0.009	10%	6.747	15.468
R111-S044-.01 CIT-5-F-DUP	17.26	5.021	0.087	0.190	0.009	10%	6.747	15.557
R111-S044-.01 CIT-7	17.26	5.041	0.087	0.790	0.036	41%	7.261	10.208
R111-S044-.01 CIT-7-F	17.26	5.041	0.087	0.340	0.015	18%	7.261	14.225
R111-S044-.01 CIT-7-F/C	17.26	5.041	0.087	0.370	0.017	19%	7.261	13.957
R111-S044-.01 CIT-7-F-DUP	17.26	5.041	0.087	0.320	0.014	17%	7.261	14.403
R111-S049-.01 CIT-3	0.38	5.030	0.002	0.05	0.002	118%	3.257	-0.067
R111-S049-.01 CIT-3-F	0.38	5.030	0.002	0.05	0.002	118%	3.257	-0.067
R111-S049-.01 CIT-3-F/C	0.38	5.030	0.002	0.05	0.002	118%	3.257	-0.067
R111-S049-.01 CIT-3-F-DUP	0.38	5.030	0.002	0.05	0.002	118%	3.257	-0.067
R111-S049-.01 CIT-5	0.38	5.009	0.002	0.05	0.002	118%	5.163	-0.069
R111-S049-.01 CIT-5-F	0.38	5.009	0.002	0.05	0.002	118%	5.163	-0.069
R111-S049-.01 CIT-5-F/C	0.38	5.009	0.002	0.05	0.002	118%	5.163	-0.069
R111-S049-.01 CIT-5-F-DUP	0.38	5.009	0.002	0.05	0.002	118%	5.163	-0.069
R111-S049-.01 CIT-7	0.38	5.008	0.002	0.05	0.002	118%	7.093	-0.069
R111-S049-.01 CIT-7-F	0.38	5.008	0.002	0.05	0.002	118%	7.093	-0.069

Cd Removed by Batch Shaker Method

SAMPLE #	Cd (mg/kg)	Wt. of Soil (g)	Cd in Soil (mg)	Cd (mg/L)	Cd in Sample (mg)	% Cd Removed	pH of Sample	Cd Remaining in Soil (mg/kg)
R111-S049-.01 CIT-7-F/C	0.38	5.008	0.002	0.05	0.002	118%	7.093	-0.069
R111-S049-.01 CIT-7-F-DUP	0.38	5.008	0.002	0.05	0.002	118%	7.093	-0.069
R111-S037-.01 EDTA-3	21.68	5.008	0.109	1.160	0.052	48%	6.715	11.257
R111-S037-.01 EDTA-3-F	21.68	5.008	0.109	1.080	0.049	45%	6.715	11.976
R111-S037-.01 EDTA-3-F/C	21.68	5.008	0.109	1.170	0.053	48%	6.715	11.167
R111-S037-.01 EDTA-3-F-DUP	21.68	5.008	0.109	1.130	0.051	47%	6.715	11.526
R111-S037-.01 EDTA-5	21.68	5.007	0.109	1.000	0.045	41%	7.113	12.693
R111-S037-.01 EDTA-5-F	21.68	5.007	0.109	1.080	0.049	45%	7.113	11.974
R111-S037-.01 EDTA-5-F/C	21.68	5.007	0.109	1.150	0.052	48%	7.113	11.344
R111-S037-.01 EDTA-5-F-DUP	21.68	5.007	0.109	1.200	0.054	50%	7.113	10.895
R111-S037-.01 EDTA-7	21.68	5.010	0.109	0.680	0.031	28%	7.229	15.572
R111-S037-.01 EDTA-7-F	21.68	5.010	0.109	0.710	0.032	29%	7.229	15.303
R111-S037-.01 EDTA-7-F/C	21.68	5.010	0.109	0.700	0.032	29%	7.229	15.393
R111-S037-.01 EDTA-7-F-DUP	21.68	5.010	0.109	0.710	0.032	29%	7.229	15.303
R111-S038-.01 EDTA-3	25.72	5.024	0.129	1.810	0.081	63%	6.884	9.508
R111-S038-.01 EDTA-3-F	25.72	5.024	0.129	1.750	0.079	61%	6.884	10.045
R111-S038-.01 EDTA-3-F/C	25.72	5.024	0.129	1.650	0.074	57%	6.884	10.941
R111-S038-.01 EDTA-3-F-DUP	25.72	5.024	0.129	1.760	0.079	61%	6.884	9.956
R111-S038-.01 EDTA-5	25.72	5.009	0.129	1.160	0.052	41%	6.982	15.299
R111-S038-.01 EDTA-5-F	25.72	5.009	0.129	1.210	0.054	42%	6.982	14.850
R111-S038-.01 EDTA-5-F/C	25.72	5.009	0.129	1.180	0.053	41%	6.982	15.119
R111-S038-.01 EDTA-5-F-DUP	25.72	5.009	0.129	1.330	0.060	46%	6.982	13.772
R111-S038-.01 EDTA-7	25.72	5.019	0.129	0.940	0.042	33%	7.204	17.292
R111-S038-.01 EDTA-7-F	25.72	5.019	0.129	1.070	0.048	37%	7.204	16.126
R111-S038-.01 EDTA-7-F/C	25.72	5.019	0.129	1.190	0.054	41%	7.204	15.051
R111-S038-.01 EDTA-7-F-DUP	25.72	5.019	0.129	1.030	0.046	36%	7.204	16.485
R111-S039-.01 EDTA-3	79.98	5.026	0.402	8.940	0.402	100%	6.401	-0.064
R111-S039-.01 EDTA-3-F	79.98	5.026	0.402	8.590	0.387	96%	6.401	3.070
R111-S039-.01 EDTA-3-F/C	79.98	5.026	0.402	8.880	0.400	99%	6.401	0.473
R111-S039-.01 EDTA-3-F-DUP	79.98	5.026	0.402	9.260	0.417	104%	6.401	-2.929
R111-S039-.01 EDTA-5	79.98	5.041	0.403	7.730	0.348	86%	6.854	10.976
R111-S039-.01 EDTA-5-F	79.98	5.041	0.403	7.500	0.338	84%	6.854	13.029
R111-S039-.01 EDTA-5-F/C	79.98	5.041	0.403	7.750	0.349	87%	6.854	10.797
R111-S039-.01 EDTA-5-F-DUP	79.98	5.041	0.403	8.400	0.378	94%	6.854	4.995
R111-S039-.01 EDTA-7	79.98	5.031	0.402	6.890	0.310	77%	7.186	18.352

Cd Removed by Batch Shaker Method

SAMPLE #	Cd (mg/kg)	Wt. of Soil (g)	Cd in Soil (mg)	Cd (mg/L)	Cd in Sample (mg)	% Cd Removed	pH of Sample	Cd Remaining in Soil (mg/kg)
R111-S039-.01 EDTA-7-F	79.98	5.031	0.402	7.570	0.341	85%	7.186	12.270
R111-S039-.01 EDTA-7-F/C	79.98	5.031	0.402	7.080	0.319	79%	7.186	16.653
R111-S039-.01 EDTA-7-F-DUP	79.98	5.031	0.402	7.010	0.315	78%	7.186	17.279
R111-S041-.01 EDTA-3	50.75	5.031	0.255	7.690	0.346	136%	6.214	-18.034
R111-S041-.01 EDTA-3-F	50.75	5.031	0.255	6.900	0.311	122%	6.214	-10.967
R111-S041-.01 EDTA-3-F/C	50.75	5.031	0.255	7.150	0.322	126%	6.214	-13.203
R111-S041-.01 EDTA-3-F-DUP	50.75	5.031	0.255	7.340	0.330	129%	6.214	-14.903
R111-S041-.01 EDTA-5	50.75	5.036	0.256	5.730	0.258	101%	6.887	-0.451
R111-S041-.01 EDTA-5-F	50.75	5.036	0.256	5.750	0.259	101%	6.887	-0.630
R111-S041-.01 EDTA-5-F/C	50.75	5.036	0.256	6.170	0.278	109%	6.887	-4.383
R111-S041-.01 EDTA-5-F-DUP	50.75	5.036	0.256	6.340	0.285	112%	6.887	-5.902
R111-S041-.01 EDTA-7	50.75	5.027	0.255	5.540	0.249	98%	7.431	1.158
R111-S041-.01 EDTA-7-F	50.75	5.027	0.255	5.330	0.240	94%	7.431	3.038
R111-S041-.01 EDTA-7-F/C	50.75	5.027	0.255	1.570	0.071	28%	7.431	36.696
R111-S041-.01 EDTA-7-F-DUP	50.75	5.027	0.255	5.670	0.255	100%	7.431	-0.006
R111-S044-.01 EDTA-3	17.26	5.036	0.087	1.570	0.071	81%	6.701	3.231
R111-S044-.01 EDTA-3-F	17.26	5.036	0.087	1.510	0.068	78%	6.701	3.767
R111-S044-.01 EDTA-3-F/C	17.26	5.036	0.087	1.600	0.072	83%	6.701	2.963
R111-S044-.01 EDTA-3-F-DUP	17.26	5.036	0.087	1.660	0.075	86%	6.701	2.427
R111-S044-.01 EDTA-5	17.26	5.034	0.087	1.070	0.048	55%	6.321	7.695
R111-S044-.01 EDTA-5-F	17.26	5.034	0.087	1.020	0.046	53%	6.321	8.142
R111-S044-.01 EDTA-5-F/C	17.26	5.034	0.087	1.060	0.048	55%	6.321	7.784
R111-S044-.01 EDTA-5-F-DUP	17.26	5.034	0.087	1.060	0.048	55%	6.321	7.784
R111-S044-.01 EDTA-7	17.26	5.013	0.087	0.720	0.032	37%	7.847	10.797
R111-S044-.01 EDTA-7-F	17.26	5.013	0.087	0.860	0.039	45%	7.847	9.540
R111-S044-.01 EDTA-7-F/C	17.26	5.013	0.087	0.870	0.039	45%	7.847	9.450
R111-S044-.01 EDTA-7-F-DUP	17.26	5.013	0.087	0.810	0.036	42%	7.847	9.989
R111-S049-.01 EDTA-3	0.38	5.041	0.002	0.05	0.002	117%	3.183	-0.066
R111-S049-.01 EDTA-3-F	0.38	5.041	0.002	0.05	0.002	117%	3.183	-0.066
R111-S049-.01 EDTA-3-F/C	0.38	5.041	0.002	0.05	0.002	117%	3.183	-0.066
R111-S049-.01 EDTA-3-F-DUP	0.38	5.041	0.002	0.05	0.002	117%	3.183	-0.066
R111-S049-.01 EDTA-5	0.38	5.027	0.002	0.05	0.002	118%	5.076	-0.068
R111-S049-.01 EDTA-5-F	0.38	5.027	0.002	0.05	0.002	118%	5.076	-0.068
R111-S049-.01 EDTA-5-F/C	0.38	5.027	0.002	0.05	0.002	118%	5.076	-0.068
R111-S049-.01 EDTA-5-F-DUP	0.38	5.027	0.002	0.05	0.002	118%	5.076	-0.068

Cd Removed by Batch Shaker Method

SAMPLE #	Cd (mg/kg)	Wt. of Soil (g)	Cd in Soil (mg)	Cd (mg/L)	Cd in Sample (mg)	% Cd Removed	pH of Sample	Cd Remaining in Soil (mg/kg)
R111-S049-.01 EDTA-7	0.38	5.033	0.002	0.05	0.002	118%	7.101	-0.067
R111-S049-.01 EDTA-7-F	0.38	5.033	0.002	0.05	0.002	118%	7.101	-0.067
R111-S049-.01 EDTA-7-F/C	0.38	5.033	0.002	0.05	0.002	118%	7.101	-0.067
R111-S049-.01 EDTA-7-F-DUP	0.38	5.033	0.002	0.05	0.002	118%	7.101	-0.067

Cr Removed by Batch Shaker Method

SAMPLE #	Cr (mg/kg)	Wt. of Soil (g)	Cr in Soil (mg)	Cr (mg/L)	Cr in Sample (mg)	% Cr Removed	pH of Sample	Cr Remaining in Soil (mg/kg)
R111-S037-.01 CIT-3	0.43	5.003	0.002	0.150	0.002	70%	5.915	0.130
R111-S037-.01 CIT-3-F	0.43	5.003	0.002	0.150	0.002	70%	5.915	0.130
R111-S037-.01 CIT-3-F/C	0.43	5.003	0.002	0.150	0.002	70%	5.915	0.130
R111-S037-.01 CIT-3-F-DUP	0.43	5.003	0.002	0.150	0.002	70%	5.915	0.130
R111-S037-.01 CIT-5	0.43	5.010	0.002	0.150	0.002	70%	6.409	0.131
R111-S037-.01 CIT-5-F	0.43	5.010	0.002	0.150	0.002	70%	6.409	0.131
R111-S037-.01 CIT-5-F/C	0.43	5.010	0.002	0.150	0.002	70%	6.409	0.131
R111-S037-.01 CIT-5-F-DUP	0.43	5.010	0.002	0.150	0.002	70%	6.409	0.131
R111-S037-.01 CIT-7	0.43	5.036	0.002	0.150	0.002	69%	7.698	0.132
R111-S037-.01 CIT-7-F	0.43	5.036	0.002	0.150	0.002	69%	7.698	0.132
R111-S037-.01 CIT-7-F/C	0.43	5.036	0.002	0.150	0.002	69%	7.698	0.132
R111-S037-.01 CIT-7-F-DUP	0.43	5.036	0.002	0.150	0.002	69%	7.698	0.132
R111-S038-.01 CIT-3	0.43	5.014	0.002	0.150	0.002	70%	6.237	0.131
R111-S038-.01 CIT-3-F	0.43	5.014	0.002	0.150	0.002	70%	6.237	0.131
R111-S038-.01 CIT-3-F/C	0.43	5.014	0.002	0.150	0.002	70%	6.237	0.131
R111-S038-.01 CIT-3-F-DUP	0.43	5.014	0.002	0.150	0.002	70%	6.237	0.131
R111-S038-.01 CIT-5	0.43	5.014	0.002	0.150	0.002	70%	6.736	0.131
R111-S038-.01 CIT-5-F	0.43	5.014	0.002	0.150	0.002	70%	6.736	0.131
R111-S038-.01 CIT-5-F/C	0.43	5.014	0.002	0.150	0.002	70%	6.736	0.131
R111-S038-.01 CIT-5-F-DUP	0.43	5.014	0.002	0.150	0.002	70%	6.736	0.131
R111-S038-.01 CIT-7	0.43	5.030	0.002	0.150	0.002	69%	7.734	0.132
R111-S038-.01 CIT-7-F	0.43	5.030	0.002	0.150	0.002	69%	7.734	0.132
R111-S038-.01 CIT-7-F/C	0.43	5.030	0.002	0.150	0.002	69%	7.734	0.132
R111-S038-.01 CIT-7-F-DUP	0.43	5.030	0.002	0.150	0.002	69%	7.734	0.132
R111-S039-.01 CIT-3	0.43	5.008	0.002	0.150	0.002	70%	6.304	0.130
R111-S039-.01 CIT-3-F	0.43	5.008	0.002	0.150	0.002	70%	6.304	0.130
R111-S039-.01 CIT-3-F/C	0.43	5.008	0.002	0.150	0.002	70%	6.304	0.130
R111-S039-.01 CIT-3-F-DUP	0.43	5.008	0.002	0.150	0.002	70%	6.304	0.130
R111-S039-.01 CIT-5	0.43	5.041	0.002	0.150	0.002	69%	6.321	0.132
R111-S039-.01 CIT-5-F	0.43	5.041	0.002	0.150	0.002	69%	6.321	0.132
R111-S039-.01 CIT-5-F/C	0.43	5.041	0.002	0.150	0.002	69%	6.321	0.132
R111-S039-.01 CIT-5-F-DUP	0.43	5.041	0.002	0.150	0.002	69%	6.321	0.132
R111-S039-.01 CIT-7	0.43	5.029	0.002	0.270	0.003	125%	7.421	-0.107
R111-S039-.01 CIT-7-F	0.43	5.029	0.002	0.150	0.002	69%	7.421	0.132
R111-S039-.01 CIT-7-F/C	0.43	5.029	0.002	0.150	0.002	69%	7.421	0.132

Cr Removed by Batch Shaker Method

SAMPLE #	Cr (mg/kg)	Wt. of Soil (g)	Cr in Soil (mg)	Cr (mg/L)	Cr in Sample (mg)	% Cr Removed	pH of Sample	Cr Remaining in Soil (mg/kg)
R111-S039-.01 CIT-7-F-DUP	0.43	5.029	0.002	0.170	0.002	79%	7.421	0.092
R111-S041-.01 CIT-3	0.20	5.002	0.001	0.150	0.002	150%	5.861	-0.100
R111-S041-.01 CIT-3-F	0.20	5.002	0.001	0.150	0.002	150%	5.861	-0.100
R111-S041-.01 CIT-3-F/C	0.20	5.002	0.001	0.170	0.002	170%	5.861	-0.140
R111-S041-.01 CIT-3-F-DUP	0.20	5.002	0.001	0.220	0.002	220%	5.861	-0.240
R111-S041-.01 CIT-5	0.20	5.036	0.001	0.150	0.002	149%	6.498	-0.098
R111-S041-.01 CIT-5-F	0.20	5.036	0.001	0.150	0.002	149%	6.498	-0.098
R111-S041-.01 CIT-5-F/C	0.20	5.036	0.001	0.150	0.002	149%	6.498	-0.098
R111-S041-.01 CIT-5-F-DUP	0.20	5.036	0.001	0.150	0.002	149%	6.498	-0.098
R111-S041-.01 CIT-7	0.20	5.041	0.001	0.240	0.002	238%	7.601	-0.276
R111-S041-.01 CIT-7-F	0.20	5.041	0.001	0.150	0.002	149%	7.601	-0.098
R111-S041-.01 CIT-7-F/C	0.20	5.041	0.001	0.150	0.002	149%	7.601	-0.098
R111-S041-.01 CIT-7-F-DUP	0.20	5.041	0.001	0.150	0.002	149%	7.601	-0.098
R111-S044-.01 CIT-3	0.20	5.021	0.001	0.150	0.002	149%	6.432	-0.099
R111-S044-.01 CIT-3-F	0.20	5.021	0.001	0.150	0.002	149%	6.432	-0.099
R111-S044-.01 CIT-3-F/C	0.20	5.021	0.001	0.150	0.002	149%	6.432	-0.099
R111-S044-.01 CIT-3-F-DUP	0.20	5.021	0.001	0.150	0.002	149%	6.432	-0.099
R111-S044-.01 CIT-5	0.20	5.021	0.001	0.150	0.002	149%	6.747	-0.099
R111-S044-.01 CIT-5-F	0.20	5.021	0.001	0.150	0.002	149%	6.747	-0.099
R111-S044-.01 CIT-5-F/C	0.20	5.021	0.001	0.150	0.002	149%	6.747	-0.099
R111-S044-.01 CIT-5-F-DUP	0.20	5.021	0.001	0.150	0.002	149%	6.747	-0.099
R111-S044-.01 CIT-7	0.20	5.041	0.001	0.160	0.002	159%	7.261	-0.117
R111-S044-.01 CIT-7-F	0.20	5.041	0.001	0.150	0.002	149%	7.261	-0.098
R111-S044-.01 CIT-7-F/C	0.20	5.041	0.001	0.150	0.002	149%	7.261	-0.098
R111-S044-.01 CIT-7-F-DUP	0.20	5.041	0.001	0.150	0.002	149%	7.261	-0.098
R111-S049-.01 CIT-3	0.20	5.030	0.001	0.150	0.002	149%	3.257	-0.098
R111-S049-.01 CIT-3-F	0.20	5.030	0.001	0.150	0.002	149%	3.257	-0.098
R111-S049-.01 CIT-3-F/C	0.20	5.030	0.001	0.150	0.002	149%	3.257	-0.098
R111-S049-.01 CIT-3-F-DUP	0.20	5.030	0.001	0.150	0.002	149%	3.257	-0.098
R111-S049-.01 CIT-5	0.20	5.009	0.001	0.150	0.002	150%	5.163	-0.099
R111-S049-.01 CIT-5-F	0.20	5.009	0.001	0.150	0.002	150%	5.163	-0.099
R111-S049-.01 CIT-5-F/C	0.20	5.009	0.001	0.150	0.002	150%	5.163	-0.099
R111-S049-.01 CIT-5-F-DUP	0.20	5.009	0.001	0.150	0.002	150%	5.163	-0.099
R111-S049-.01 CIT-7	0.20	5.008	0.001	0.150	0.002	150%	7.093	-0.100
R111-S049-.01 CIT-7-F	0.20	5.008	0.001	0.150	0.002	150%	7.093	-0.100

Cr Removed by Batch Shaker Method

SAMPLE #	Cr (mg/kg)	Wt. of Soil (g)	Cr in Soil (mg)	Cr (mg/L)	Cr in Sample (mg)	% Cr Removed	pH of Sample	Cr Remaining in Soil (mg/kg)
R111-S049-.01 CIT-7-F/C	0.20	5.008	0.001	0.150	0.002	150%	7.093	-0.100
R111-S049-.01 CIT-7-F-DUP	0.20	5.008	0.001	0.150	0.002	150%	7.093	-0.100
R111-S037-.01 EDTA-3	0.43	5.008	0.002	0.150	0.002	70%	6.715	0.130
R111-S037-.01 EDTA-3-F	0.43	5.008	0.002	0.150	0.002	70%	6.715	0.130
R111-S037-.01 EDTA-3-F/C	0.43	5.008	0.002	0.150	0.002	70%	6.715	0.130
R111-S037-.01 EDTA-3-F-DUP	0.43	5.008	0.002	0.150	0.002	70%	6.715	0.130
R111-S037-.01 EDTA-5	0.43	5.007	0.002	0.150	0.002	70%	7.113	0.130
R111-S037-.01 EDTA-5-F	0.43	5.007	0.002	0.150	0.002	70%	7.113	0.130
R111-S037-.01 EDTA-5-F/C	0.43	5.007	0.002	0.150	0.002	70%	7.113	0.130
R111-S037-.01 EDTA-5-F-DUP	0.43	5.007	0.002	0.150	0.002	70%	7.113	0.130
R111-S037-.01 EDTA-7	0.43	5.010	0.002	0.150	0.002	70%	7.229	0.131
R111-S037-.01 EDTA-7-F	0.43	5.010	0.002	0.150	0.002	70%	7.229	0.131
R111-S037-.01 EDTA-7-F/C	0.43	5.010	0.002	0.150	0.002	70%	7.229	0.131
R111-S037-.01 EDTA-7-F-DUP	0.43	5.010	0.002	0.150	0.002	70%	7.229	0.131
R111-S038-.01 EDTA-3	0.43	5.024	0.002	0.150	0.002	69%	6.884	0.131
R111-S038-.01 EDTA-3-F	0.43	5.024	0.002	0.150	0.002	69%	6.884	0.131
R111-S038-.01 EDTA-3-F/C	0.43	5.024	0.002	0.150	0.002	69%	6.884	0.131
R111-S038-.01 EDTA-3-F-DUP	0.43	5.024	0.002	0.150	0.002	69%	6.884	0.131
R111-S038-.01 EDTA-5	0.43	5.009	0.002	0.150	0.002	70%	6.982	0.131
R111-S038-.01 EDTA-5-F	0.43	5.009	0.002	0.150	0.002	70%	6.982	0.131
R111-S038-.01 EDTA-5-F/C	0.43	5.009	0.002	0.150	0.002	70%	6.982	0.131
R111-S038-.01 EDTA-5-F-DUP	0.43	5.009	0.002	0.150	0.002	70%	6.982	0.131
R111-S038-.01 EDTA-7	0.43	5.019	0.002	0.150	0.002	70%	7.204	0.131
R111-S038-.01 EDTA-7-F	0.43	5.019	0.002	0.150	0.002	70%	7.204	0.131
R111-S038-.01 EDTA-7-F/C	0.43	5.019	0.002	0.150	0.002	70%	7.204	0.131
R111-S038-.01 EDTA-7-F-DUP	0.43	5.019	0.002	0.150	0.002	70%	7.204	0.131
R111-S039-.01 EDTA-3	0.43	5.026	0.002	0.150	0.002	69%	6.401	0.132
R111-S039-.01 EDTA-3-F	0.43	5.026	0.002	0.150	0.002	69%	6.401	0.132
R111-S039-.01 EDTA-3-F/C	0.43	5.026	0.002	0.150	0.002	69%	6.401	0.132
R111-S039-.01 EDTA-3-F-DUP	0.43	5.026	0.002	0.150	0.002	69%	6.401	0.132
R111-S039-.01 EDTA-5	0.43	5.041	0.002	0.150	0.002	69%	6.854	0.132
R111-S039-.01 EDTA-5-F	0.43	5.041	0.002	0.150	0.002	69%	6.854	0.132
R111-S039-.01 EDTA-5-F/C	0.43	5.041	0.002	0.150	0.002	69%	6.854	0.132
R111-S039-.01 EDTA-5-F-DUP	0.43	5.041	0.002	0.150	0.002	69%	6.854	0.132
R111-S039-.01 EDTA-7	0.43	5.031	0.002	0.150	0.002	69%	7.186	0.132

Cr Removed by Batch Shaker Method

SAMPLE #	Cr (mg/kg)	Wt. of Soil (g)	Cr in Soil (mg)	Cr (mg/L)	Cr in Sample (mg)	% Cr Removed	pH of Sample	Cr Remaining in Soil (mg/kg)
R111-S039-.01 EDTA-7-F	0.43	5.031	0.002	0.150	0.002	69%	7.186	0.132
R111-S039-.01 EDTA-7-F/C	0.43	5.031	0.002	0.150	0.002	69%	7.186	0.132
R111-S039-.01 EDTA-7-F-DUP	0.43	5.031	0.002	0.150	0.002	69%	7.186	0.132
R111-S041-.01 EDTA-3	0.20	5.031	0.001	0.150	0.002	149%	6.214	-0.098
R111-S041-.01 EDTA-3-F	0.20	5.031	0.001	0.150	0.002	149%	6.214	-0.098
R111-S041-.01 EDTA-3-F/C	0.20	5.031	0.001	0.150	0.002	149%	6.214	-0.098
R111-S041-.01 EDTA-3-F-DUP	0.20	5.031	0.001	0.150	0.002	149%	6.214	-0.098
R111-S041-.01 EDTA-5	0.20	5.036	0.001	0.150	0.002	149%	6.887	-0.098
R111-S041-.01 EDTA-5-F	0.20	5.036	0.001	0.150	0.002	149%	6.887	-0.098
R111-S041-.01 EDTA-5-F/C	0.20	5.036	0.001	0.150	0.002	149%	6.887	-0.098
R111-S041-.01 EDTA-5-F-DUP	0.20	5.036	0.001	0.150	0.002	149%	6.887	-0.098
R111-S041-.01 EDTA-7	0.20	5.027	0.001	0.150	0.002	149%	7.431	-0.098
R111-S041-.01 EDTA-7-F	0.20	5.027	0.001	0.150	0.002	149%	7.431	-0.098
R111-S041-.01 EDTA-7-F/C	0.20	5.027	0.001	0.150	0.002	149%	7.431	-0.098
R111-S041-.01 EDTA-7-F-DUP	0.20	5.027	0.001	0.150	0.002	149%	7.431	-0.098
R111-S044-.01 EDTA-3	0.20	5.036	0.001	0.150	0.002	149%	6.701	-0.098
R111-S044-.01 EDTA-3-F	0.20	5.036	0.001	0.150	0.002	149%	6.701	-0.098
R111-S044-.01 EDTA-3-F/C	0.20	5.036	0.001	0.150	0.002	149%	6.701	-0.098
R111-S044-.01 EDTA-3-F-DUP	0.20	5.036	0.001	0.150	0.002	149%	6.701	-0.098
R111-S044-.01 EDTA-5	0.20	5.034	0.001	0.150	0.002	149%	6.321	-0.098
R111-S044-.01 EDTA-5-F	0.20	5.034	0.001	0.150	0.002	149%	6.321	-0.098
R111-S044-.01 EDTA-5-F/C	0.20	5.034	0.001	0.150	0.002	149%	6.321	-0.098
R111-S044-.01 EDTA-5-F-DUP	0.20	5.034	0.001	0.150	0.002	149%	6.321	-0.098
R111-S044-.01 EDTA-7	0.20	5.013	0.001	0.150	0.002	150%	7.847	-0.099
R111-S044-.01 EDTA-7-F	0.20	5.013	0.001	0.150	0.002	150%	7.847	-0.099
R111-S044-.01 EDTA-7-F/C	0.20	5.013	0.001	0.150	0.002	150%	7.847	-0.099
R111-S044-.01 EDTA-7-F-DUP	0.20	5.013	0.001	0.150	0.002	150%	7.847	-0.099
R111-S049-.01 EDTA-3	0.20	5.041	0.001	0.150	0.002	149%	3.183	-0.098
R111-S049-.01 EDTA-3-F	0.20	5.041	0.001	0.150	0.002	149%	3.183	-0.098
R111-S049-.01 EDTA-3-F/C	0.20	5.041	0.001	0.150	0.002	149%	3.183	-0.098
R111-S049-.01 EDTA-3-F-DUP	0.20	5.041	0.001	0.150	0.002	149%	3.183	-0.098
R111-S049-.01 EDTA-5	0.20	5.027	0.001	0.150	0.002	149%	5.076	-0.098
R111-S049-.01 EDTA-5-F	0.20	5.027	0.001	0.150	0.002	149%	5.076	-0.098
R111-S049-.01 EDTA-5-F/C	0.20	5.027	0.001	0.150	0.002	149%	5.076	-0.098
R111-S049-.01 EDTA-5-F-DUP	0.20	5.027	0.001	0.150	0.002	149%	5.076	-0.098

Cr Removed by Batch Shaker Method

SAMPLE #	Cr (mg/kg)	Wt. of Soil (g)	Cr in Soil (mg)	Cr (mg/L)	Cr in Sample (mg)	% Cr Removed	pH of Sample	Cr Remaining in Soil (mg/kg)
R111-S049.01 EDTA-7	0.20	5.033	0.001	0.150	0.002	149%	7.101	-0.098
R111-S049.01 EDTA-7-F	0.20	5.033	0.001	0.150	0.002	149%	7.101	-0.098
R111-S049.01 EDTA-7-F/C	0.20	5.033	0.001	0.150	0.002	149%	7.101	-0.098
R111-S049.01 EDTA-7-F-DUP	0.20	5.033	0.001	0.150	0.002	149%	7.101	-0.098

Cu Removed by Batch Shaker Method

SAMPLE #	Cu (mg/kg)	Wt. of Soil (g)	Cu in Soil (mg)	Cu (mg/L)	Cu in Sample (mg)	% Cu Removed	pH of Sample	Cu Remaining in Soil (mg/kg)
R111-S037-.01 CIT-3	18.93	5.003	0.095	9.190	0.414	437%	5.915	-63.730
R111-S037-.01 CIT-3-F	18.93	5.003	0.095	8.490	0.382	403%	5.915	-57.434
R111-S037-.01 CIT-3-F/C	18.93	5.003	0.095	8.540	0.384	406%	5.915	-57.884
R111-S037-.01 CIT-3-F-DUP	18.93	5.003	0.095	8.380	0.377	398%	5.915	-56.445
R111-S037-.01 CIT-5	18.93	5.010	0.095	6.740	0.303	320%	6.409	-41.609
R111-S037-.01 CIT-5-F	18.93	5.010	0.095	4.750	0.214	225%	6.409	-23.735
R111-S037-.01 CIT-5-F/C	18.93	5.010	0.095	4.640	0.209	220%	6.409	-22.747
R111-S037-.01 CIT-5-F-DUP	18.93	5.010	0.095	4.830	0.217	229%	6.409	-24.453
R111-S037-.01 CIT-7	18.93	5.036	0.095	7.230	0.325	341%	7.698	-45.675
R111-S037-.01 CIT-7-F	18.93	5.036	0.095	5.270	0.237	249%	7.698	-28.161
R111-S037-.01 CIT-7-F/C	18.93	5.036	0.095	5.200	0.234	245%	7.698	-27.535
R111-S037-.01 CIT-7-F-DUP	18.93	5.036	0.095	5.440	0.245	257%	7.698	-29.680
R111-S038-.01 CIT-3	25.45	5.014	0.128	12.600	0.567	444%	6.237	-87.633
R111-S038-.01 CIT-3-F	25.45	5.014	0.128	8.680	0.391	306%	6.237	-52.452
R111-S038-.01 CIT-3-F/C	25.45	5.014	0.128	8.690	0.391	306%	6.237	-52.542
R111-S038-.01 CIT-3-F-DUP	25.45	5.014	0.128	9.130	0.411	322%	6.237	-56.491
R111-S038-.01 CIT-5	25.45	5.014	0.128	8.560	0.385	302%	6.736	-51.375
R111-S038-.01 CIT-5-F	25.45	5.014	0.128	7.630	0.343	269%	6.736	-43.028
R111-S038-.01 CIT-5-F/C	25.45	5.014	0.128	7.250	0.326	256%	6.736	-39.618
R111-S038-.01 CIT-5-F-DUP	25.45	5.014	0.128	7.450	0.335	263%	6.736	-41.413
R111-S038-.01 CIT-7	25.45	5.030	0.128	6.110	0.275	215%	7.734	-29.212
R111-S038-.01 CIT-7-F	25.45	5.030	0.128	5.590	0.252	197%	7.734	-24.560
R111-S038-.01 CIT-7-F/C	25.45	5.030	0.128	5.480	0.247	193%	7.734	-23.576
R111-S038-.01 CIT-7-F-DUP	25.45	5.030	0.128	5.560	0.250	195%	7.734	-24.292
R111-S039-.01 CIT-3	73.42	5.008	0.368	12.280	0.553	150%	6.304	-36.923
R111-S039-.01 CIT-3-F	73.42	5.008	0.368	11.610	0.522	142%	6.304	-30.903
R111-S039-.01 CIT-3-F/C	73.42	5.008	0.368	11.710	0.527	143%	6.304	-31.802
R111-S039-.01 CIT-3-F-DUP	73.42	5.008	0.368	11.660	0.525	143%	6.304	-31.352
R111-S039-.01 CIT-5	73.42	5.041	0.370	9.320	0.419	113%	6.321	-9.778
R111-S039-.01 CIT-5-F	73.42	5.041	0.370	9.910	0.446	120%	6.321	-15.045
R111-S039-.01 CIT-5-F/C	73.42	5.041	0.370	9.810	0.441	119%	6.321	-14.152
R111-S039-.01 CIT-5-F-DUP	73.42	5.041	0.370	10.170	0.458	124%	6.321	-17.366
R111-S039-.01 CIT-7	73.42	5.029	0.369	15.470	0.696	189%	7.421	-65.007
R111-S039-.01 CIT-7-F	73.42	5.029	0.369	9.510	0.428	116%	7.421	-11.676
R111-S039-.01 CIT-7-F/C	73.42	5.029	0.369	9.070	0.408	111%	7.421	-7.739

Cu Removed by Batch Shaker Method

SAMPLE #	Cu (mg/kg)	Wt. of Soil (g)	Cu in Soil (mg)	Cu (mg/L)	Cu in Sample (mg)	% Cu Removed	pH of Sample	Cu Remaining in Soil (mg/kg)
R111-S039-.01 CIT-7-F-DUP	73.42	5.029	0.369	10.330	0.465	126%	7.421	-19.014
R111-S041-.01 CIT-3	14.61	5.002	0.073	147.460	6.636	9080%	5.861	-1311.999
R111-S041-.01 CIT-3-F	14.61	5.002	0.073	140.670	6.330	8662%	5.861	-1250.914
R111-S041-.01 CIT-3-F/C	14.61	5.002	0.073	13.640	0.614	840%	5.861	-108.101
R111-S041-.01 CIT-3-F-DUP	14.61	5.002	0.073	13.990	0.630	861%	5.861	-111.250
R111-S041-.01 CIT-5	14.61	5.036	0.074	7.660	0.345	468%	6.498	-53.837
R111-S041-.01 CIT-5-F	14.61	5.036	0.074	5.020	0.226	307%	6.498	-30.247
R111-S041-.01 CIT-5-F/C	14.61	5.036	0.074	4.960	0.223	303%	6.498	-29.711
R111-S041-.01 CIT-5-F-DUP	14.61	5.036	0.074	4.940	0.222	302%	6.498	-29.532
R111-S041-.01 CIT-7	14.61	5.041	0.074	155.620	7.003	9508%	7.601	-1374.579
R111-S041-.01 CIT-7-F	14.61	5.041	0.074	7.700	0.347	470%	7.601	-54.126
R111-S041-.01 CIT-7-F/C	14.61	5.041	0.074	7.060	0.318	431%	7.601	-48.413
R111-S041-.01 CIT-7-F-DUP	14.61	5.041	0.074	7.430	0.334	454%	7.601	-51.716
R111-S044-.01 CIT-3	7.68	5.021	0.039	8.820	0.397	1029%	6.432	-71.368
R111-S044-.01 CIT-3-F	7.68	5.021	0.039	6.650	0.299	776%	6.432	-51.920
R111-S044-.01 CIT-3-F/C	7.68	5.021	0.039	6.470	0.291	755%	6.432	-50.306
R111-S044-.01 CIT-3-F-DUP	7.68	5.021	0.039	6.610	0.297	771%	6.432	-51.561
R111-S044-.01 CIT-5	7.68	5.021	0.039	3.930	0.177	459%	6.747	-27.542
R111-S044-.01 CIT-5-F	7.68	5.021	0.039	3.960	0.178	462%	6.747	-27.811
R111-S044-.01 CIT-5-F/C	7.68	5.021	0.039	3.770	0.170	440%	6.747	-26.108
R111-S044-.01 CIT-5-F-DUP	7.68	5.021	0.039	3.930	0.177	459%	6.747	-27.542
R111-S044-.01 CIT-7	7.68	5.041	0.039	10.540	0.474	1225%	7.261	-86.408
R111-S044-.01 CIT-7-F	7.68	5.041	0.039	5.430	0.244	631%	7.261	-40.793
R111-S044-.01 CIT-7-F/C	7.68	5.041	0.039	4.980	0.224	579%	7.261	-36.775
R111-S044-.01 CIT-7-F-DUP	7.68	5.041	0.039	5.190	0.234	603%	7.261	-38.650
R111-S049-.01 CIT-3	0.75	5.030	0.004	0.100	0.005	119%	3.257	-0.145
R111-S049-.01 CIT-3-F	0.75	5.030	0.004	0.130	0.006	155%	3.257	-0.413
R111-S049-.01 CIT-3-F/C	0.75	5.030	0.004	0.120	0.005	143%	3.257	-0.324
R111-S049-.01 CIT-3-F-DUP	0.75	5.030	0.004	0.100	0.005	119%	3.257	-0.145
R111-S049-.01 CIT-5	0.75	5.009	0.004	0.250	0.011	299%	5.163	-1.496
R111-S049-.01 CIT-5-F	0.75	5.009	0.004	0.110	0.005	132%	5.163	-0.238
R111-S049-.01 CIT-5-F/C	0.75	5.009	0.004	0.120	0.005	144%	5.163	-0.328
R111-S049-.01 CIT-5-F-DUP	0.75	5.009	0.004	0.130	0.006	156%	5.163	-0.418
R111-S049-.01 CIT-7	0.75	5.008	0.004	0.250	0.011	300%	7.093	-1.496
R111-S049-.01 CIT-7-F	0.75	5.008	0.004	0.170	0.008	204%	7.093	-0.778

Cu Removed by Batch Shaker Method

SAMPLE #	Cu (mg/kg)	Wt. of Soil (g)	Cu in Soil (mg)	Cu (mg/L)	Cu in Sample (mg)	% Cu Removed	pH of Sample	Cu Remaining in Soil (mg/kg)
R111-S049-.01 CIT-7-F/C	0.75	5.008	0.004	0.250	0.011	300%	7.093	-1.496
R111-S049-.01 CIT-7-F-DUP	0.75	5.008	0.004	0.160	0.007	192%	7.093	-0.688
R111-S037-.01 EDTA-3	18.93	5.008	0.095	11.540	0.519	548%	6.715	-84.764
R111-S037-.01 EDTA-3-F	18.93	5.008	0.095	12.710	0.572	603%	6.715	-95.277
R111-S037-.01 EDTA-3-F/C	18.93	5.008	0.095	12.110	0.545	575%	6.715	-89.886
R111-S037-.01 EDTA-3-F-DUP	18.93	5.008	0.095	12.440	0.560	590%	6.715	-92.851
R111-S037-.01 EDTA-5	18.93	5.007	0.095	9.150	0.412	434%	7.113	-63.305
R111-S037-.01 EDTA-5-F	18.93	5.007	0.095	14.480	0.652	687%	7.113	-111.208
R111-S037-.01 EDTA-5-F/C	18.93	5.007	0.095	137.700	6.197	6538%	7.113	-1218.637
R111-S037-.01 EDTA-5-F-DUP	18.93	5.007	0.095	14.750	0.664	700%	7.113	-113.634
R111-S037-.01 EDTA-7	18.93	5.010	0.095	6.650	0.299	316%	7.229	-40.801
R111-S037-.01 EDTA-7-F	18.93	5.010	0.095	9.070	0.408	430%	7.229	-62.537
R111-S037-.01 EDTA-7-F/C	18.93	5.010	0.095	9.250	0.416	439%	7.229	-64.154
R111-S037-.01 EDTA-7-F-DUP	18.93	5.010	0.095	10.050	0.452	477%	7.229	-71.339
R111-S038-.01 EDTA-3	25.45	5.024	0.128	14.650	0.659	516%	6.884	-105.770
R111-S038-.01 EDTA-3-F	25.45	5.024	0.128	174.860	7.869	6154%	6.884	-1540.772
R111-S038-.01 EDTA-3-F/C	25.45	5.024	0.128	173.600	7.812	6110%	6.884	-1529.486
R111-S038-.01 EDTA-3-F-DUP	25.45	5.024	0.128	176.620	7.948	6216%	6.884	-1556.536
R111-S038-.01 EDTA-5	25.45	5.009	0.127	10.120	0.455	357%	6.982	-65.466
R111-S038-.01 EDTA-5-F	25.45	5.009	0.127	13.600	0.612	480%	6.982	-96.730
R111-S038-.01 EDTA-5-F/C	25.45	5.009	0.127	13.150	0.592	464%	6.982	-92.687
R111-S038-.01 EDTA-5-F-DUP	25.45	5.009	0.127	13.280	0.598	469%	6.982	-93.855
R111-S038-.01 EDTA-7	25.45	5.019	0.128	7.690	0.346	271%	7.204	-43.498
R111-S038-.01 EDTA-7-F	25.45	5.019	0.128	11.280	0.508	397%	7.204	-75.686
R111-S038-.01 EDTA-7-F/C	25.45	5.019	0.128	11.290	0.508	398%	7.204	-75.775
R111-S038-.01 EDTA-7-F-DUP	25.45	5.019	0.128	11.270	0.507	397%	7.204	-75.596
R111-S039-.01 EDTA-3	73.42	5.026	0.369	194.680	8.761	2374%	6.401	-1669.636
R111-S039-.01 EDTA-3-F	73.42	5.026	0.369	208.570	9.386	2543%	6.401	-1793.999
R111-S039-.01 EDTA-3-F/C	73.42	5.026	0.369	197.710	8.897	2411%	6.401	-1696.765
R111-S039-.01 EDTA-3-F-DUP	73.42	5.026	0.369	206.180	9.278	2514%	6.401	-1772.601
R111-S039-.01 EDTA-5	73.42	5.041	0.370	11.820	0.532	144%	6.854	-32.095
R111-S039-.01 EDTA-5-F	73.42	5.041	0.370	15.680	0.706	191%	6.854	-66.552
R111-S039-.01 EDTA-5-F/C	73.42	5.041	0.370	157.490	7.087	1915%	6.854	-1332.462
R111-S039-.01 EDTA-5-F-DUP	73.42	5.041	0.370	16.010	0.720	195%	6.854	-69.498
R111-S039-.01 EDTA-7	73.42	5.031	0.369	9.540	0.429	116%	7.186	-11.911

Cu Removed by Batch Shaker Method

SAMPLE #	Cu (mg/kg)	Wt. of Soil (g)	Cu in Soil (mg)	Cu (mg/L)	Cu in Sample (mg)	% Cu Removed	pH of Sample	Cu Remaining in Soil (mg/kg)
R111-S039-.01 EDTA-7-F	73.42	5.031	0.369	13.950	0.628	170%	7.186	-51.356
R111-S039-.01 EDTA-7-F/C	73.42	5.031	0.369	13.990	0.630	170%	7.186	-51.714
R111-S039-.01 EDTA-7-F-DUP	73.42	5.031	0.369	14.050	0.632	171%	7.186	-52.251
R111-S041-.01 EDTA-3	14.61	5.031	0.074	151.460	6.816	9273%	6.214	-1340.131
R111-S041-.01 EDTA-3-F	14.61	5.031	0.074	166.590	7.497	10199%	6.214	-1475.462
R111-S041-.01 EDTA-3-F/C	14.61	5.031	0.074	159.490	7.177	9764%	6.214	-1411.955
R111-S041-.01 EDTA-3-F-DUP	14.61	5.031	0.074	16.610	0.747	1017%	6.214	-133.959
R111-S041-.01 EDTA-5	14.61	5.036	0.074	10.360	0.466	634%	6.887	-77.963
R111-S041-.01 EDTA-5-F	14.61	5.036	0.074	136.180	6.128	8329%	6.887	-1202.249
R111-S041-.01 EDTA-5-F/C	14.61	5.036	0.074	13.140	0.591	804%	6.887	-102.805
R111-S041-.01 EDTA-5-F-DUP	14.61	5.036	0.074	13.850	0.623	847%	6.887	-109.149
R111-S041-.01 EDTA-7	14.61	5.027	0.073	7.850	0.353	481%	7.431	-55.661
R111-S041-.01 EDTA-7-F	14.61	5.027	0.073	11.840	0.533	725%	7.431	-91.378
R111-S041-.01 EDTA-7-F/C	14.61	5.027	0.073	11.530	0.519	706%	7.431	-88.603
R111-S041-.01 EDTA-7-F-DUP	14.61	5.027	0.073	11.810	0.531	724%	7.431	-91.109
R111-S044-.01 EDTA-3	7.68	5.036	0.039	11.090	0.499	1290%	6.701	-91.417
R111-S044-.01 EDTA-3-F	7.68	5.036	0.039	11.110	0.500	1293%	6.701	-91.595
R111-S044-.01 EDTA-3-F/C	7.68	5.036	0.039	10.520	0.473	1224%	6.701	-86.323
R111-S044-.01 EDTA-3-F-DUP	7.68	5.036	0.039	11.330	0.510	1318%	6.701	-93.561
R111-S044-.01 EDTA-5	7.68	5.034	0.039	8.080	0.364	940%	6.321	-64.549
R111-S044-.01 EDTA-5-F	7.68	5.034	0.039	11.330	0.510	1319%	6.321	-93.601
R111-S044-.01 EDTA-5-F/C	7.68	5.034	0.039	10.680	0.481	1243%	6.321	-87.791
R111-S044-.01 EDTA-5-F-DUP	7.68	5.034	0.039	11.190	0.504	1302%	6.321	-92.350
R111-S044-.01 EDTA-7	7.68	5.013	0.038	5.110	0.230	597%	7.847	-38.191
R111-S044-.01 EDTA-7-F	7.68	5.013	0.038	7.400	0.333	865%	7.847	-58.747
R111-S044-.01 EDTA-7-F/C	7.68	5.013	0.038	7.230	0.325	845%	7.847	-57.221
R111-S044-.01 EDTA-7-F-DUP	7.68	5.013	0.038	7.280	0.328	851%	7.847	-57.670
R111-S049-.01 EDTA-3	0.75	5.041	0.004	0.190	0.009	226%	3.183	-0.946
R111-S049-.01 EDTA-3-F	0.75	5.041	0.004	0.230	0.010	274%	3.183	-1.303
R111-S049-.01 EDTA-3-F/C	0.75	5.041	0.004	0.220	0.010	262%	3.183	-1.214
R111-S049-.01 EDTA-3-F-DUP	0.75	5.041	0.004	0.250	0.011	298%	3.183	-1.482
R111-S049-.01 EDTA-5	0.75	5.027	0.004	0.160	0.007	191%	5.076	-0.682
R111-S049-.01 EDTA-5-F	0.75	5.027	0.004	0.230	0.010	275%	5.076	-1.309
R111-S049-.01 EDTA-5-F/C	0.75	5.027	0.004	0.230	0.010	275%	5.076	-1.309
R111-S049-.01 EDTA-5-F-DUP	0.75	5.027	0.004	0.240	0.011	286%	5.076	-1.398

Cu Removed by Batch Shaker Method

SAMPLE #	Cu (mg/kg)	Wt. of Soil (g)	Cu in Soil (mg)	Cu (mg/L)	Cu in Sample (mg)	% Cu Removed	pH of Sample	Cu Remaining in Soil (mg/kg)
R111-S049-.01 EDTA-7	0.75	5.033	0.004	0.230	0.010	274%	7.101	-1.306
R111-S049-.01 EDTA-7-F	0.75	5.033	0.004	0.220	0.010	262%	7.101	-1.217
R111-S049-.01 EDTA-7-F/C	0.75	5.033	0.004	0.260	0.012	310%	7.101	-1.575
R111-S049-.01 EDTA-7-F-DUP	0.75	5.033	0.004	0.250	0.011	298%	7.101	-1.485

Fe Removed by Batch Shaker Method

SAMPLE #	Fe (mg/kg)	Wt. of Soil (g)	Fe in Soil (mg)	Fe (mg/L)	Fe in Sample (mg)	% Fe Removed	pH of Sample
R111-S037-.01 CIT-3	975.68	5.003	4.881	32.630	1.468	30%	5.915
R111-S037-.01 CIT-3-F	975.68	5.003	4.881	28.580	1.286	26%	5.915
R111-S037-.01 CIT-3-F/C	975.68	5.003	4.881	28.060	1.263	26%	5.915
R111-S037-.01 CIT-3-F-DUP	975.68	5.003	4.881	27.570	1.241	25%	5.915
R111-S037-.01 CIT-5	975.68	5.010	4.888	16.550	0.745	15%	6.409
R111-S037-.01 CIT-5-F	975.68	5.010	4.888	13.970	0.629	13%	6.409
R111-S037-.01 CIT-5-F/C	975.68	5.010	4.888	13.300	0.599	12%	6.409
R111-S037-.01 CIT-5-F-DUP	975.68	5.010	4.888	14.210	0.639	13%	6.409
R111-S037-.01 CIT-7	975.68	5.036	4.914	36.450	1.640	33%	7.698
R111-S037-.01 CIT-7-F	975.68	5.036	4.914	6.860	0.309	6%	7.698
R111-S037-.01 CIT-7-F/C	975.68	5.036	4.914	6.880	0.310	6%	7.698
R111-S037-.01 CIT-7-F-DUP	975.68	5.036	4.914	6.770	0.305	6%	7.698
R111-S038-.01 CIT-3	1523.36	5.014	7.638	53.830	2.422	32%	6.237
R111-S038-.01 CIT-3-F	1523.36	5.014	7.638	56.660	2.550	33%	6.237
R111-S038-.01 CIT-3-F/C	1523.36	5.014	7.638	60.940	2.742	36%	6.237
R111-S038-.01 CIT-3-F-DUP	1523.36	5.014	7.638	115.500	5.198	68%	6.237
R111-S038-.01 CIT-5	1523.36	5.014	7.638	15.950	0.718	9%	6.736
R111-S038-.01 CIT-5-F	1523.36	5.014	7.638	23.810	1.071	14%	6.736
R111-S038-.01 CIT-5-F/C	1523.36	5.014	7.638	22.750	1.024	13%	6.736
R111-S038-.01 CIT-5-F-DUP	1523.36	5.014	7.638	24.660	1.110	15%	6.736
R111-S038-.01 CIT-7	1523.36	5.030	7.663	8.090	0.364	5%	7.734
R111-S038-.01 CIT-7-F	1523.36	5.030	7.663	7.890	0.355	5%	7.734
R111-S038-.01 CIT-7-F/C	1523.36	5.030	7.663	8.020	0.361	5%	7.734
R111-S038-.01 CIT-7-F-DUP	1523.36	5.030	7.663	7.710	0.347	5%	7.734
R111-S039-.01 CIT-3	662.09	5.008	3.316	29.130	1.311	40%	6.304
R111-S039-.01 CIT-3-F	662.09	5.008	3.316	29.770	1.340	40%	6.304
R111-S039-.01 CIT-3-F/C	662.09	5.008	3.316	28.590	1.287	39%	6.304
R111-S039-.01 CIT-3-F-DUP	662.09	5.008	3.316	28.570	1.286	39%	6.304
R111-S039-.01 CIT-5	662.09	5.041	3.338	7.210	0.324	10%	6.321
R111-S039-.01 CIT-5-F	662.09	5.041	3.338	6.870	0.309	9%	6.321
R111-S039-.01 CIT-5-F/C	662.09	5.041	3.338	7.150	0.322	10%	6.321
R111-S039-.01 CIT-5-F-DUP	662.09	5.041	3.338	7.070	0.318	10%	6.321
R111-S039-.01 CIT-7	662.09	5.029	3.330	112.060	5.043	151%	7.421
R111-S039-.01 CIT-7-F	662.09	5.029	3.330	30.590	1.377	41%	7.421
R111-S039-.01 CIT-7-F/C	662.09	5.029	3.330	26.190	1.179	35%	7.421

Fe Removed by Batch Shaker Method

SAMPLE #	Fe (mg/kg)	wt. of soil (g)	mg Fe in soil	Fe (mg/L)	mg Fe in sample	% Fe removed	pH of sample
R111-S039-.01 CIT-7-F-DUP	662.09	5.029	3.330	32.340	1.455	44%	7.421
R111-S041-.01 CIT-3	193.56	5.002	0.968	35.040	1.577	163%	5.861
R111-S041-.01 CIT-3-F	193.56	5.002	0.968	28.400	1.278	132%	5.861
R111-S041-.01 CIT-3-F/C	193.56	5.002	0.968	34.870	1.569	162%	5.861
R111-S041-.01 CIT-3-F-DUP	193.56	5.002	0.968	34.390	1.548	160%	5.861
R111-S041-.01 CIT-5	193.56	5.036	0.975	10.570	0.476	49%	6.498
R111-S041-.01 CIT-5-F	193.56	5.036	0.975	6.200	0.279	29%	6.498
R111-S041-.01 CIT-5-F/C	193.56	5.036	0.975	7.020	0.316	32%	6.498
R111-S041-.01 CIT-5-F-DUP	193.56	5.036	0.975	6.340	0.285	29%	6.498
R111-S041-.01 CIT-7	193.56	5.041	0.976	93.100	4.190	429%	7.601
R111-S041-.01 CIT-7-F	193.56	5.041	0.976	18.180	0.818	84%	7.601
R111-S041-.01 CIT-7-F/C	193.56	5.041	0.976	16.740	0.753	77%	7.601
R111-S041-.01 CIT-7-F-DUP	193.56	5.041	0.976	19.160	0.862	88%	7.601
R111-S044-.01 CIT-3	400.10	5.021	2.009	20.610	0.927	46%	6.432
R111-S044-.01 CIT-3-F	400.10	5.021	2.009	20.650	0.929	46%	6.432
R111-S044-.01 CIT-3-F/C	400.10	5.021	2.009	21.190	0.954	47%	6.432
R111-S044-.01 CIT-3-F-DUP	400.10	5.021	2.009	19.410	0.873	43%	6.432
R111-S044-.01 CIT-5	400.10	5.021	2.009	15.710	0.707	35%	6.747
R111-S044-.01 CIT-5-F	400.10	5.021	2.009	7.610	0.342	17%	6.747
R111-S044-.01 CIT-5-F/C	400.10	5.021	2.009	7.560	0.340	17%	6.747
R111-S044-.01 CIT-5-F-DUP	400.10	5.021	2.009	7.500	0.338	17%	6.747
R111-S044-.01 CIT-7	400.10	5.041	2.017	67.300	3.029	150%	7.261
R111-S044-.01 CIT-7-F	400.10	5.041	2.017	14.650	0.659	33%	7.261
R111-S044-.01 CIT-7-F/C	400.10	5.041	2.017	14.690	0.661	33%	7.261
R111-S044-.01 CIT-7-F-DUP	400.10	5.041	2.017	28.260	1.272	63%	7.261
R111-S049-.01 CIT-3	1.68	5.030	0.008	28.680	1.291	15273%	3.257
R111-S049-.01 CIT-3-F	1.68	5.030	0.008	34.670	1.560	18462%	3.257
R111-S049-.01 CIT-3-F/C	1.68	5.030	0.008	34.220	1.540	18223%	3.257
R111-S049-.01 CIT-3-F-DUP	1.68	5.030	0.008	33.930	1.527	18068%	3.257
R111-S049-.01 CIT-5	1.68	5.009	0.008	163.400	7.353	87378%	5.163
R111-S049-.01 CIT-5-F	1.68	5.009	0.008	17.840	0.803	9540%	5.163
R111-S049-.01 CIT-5-F/C	1.68	5.009	0.008	20.350	0.916	10882%	5.163
R111-S049-.01 CIT-5-F-DUP	1.68	5.009	0.008	29.580	1.331	15818%	5.163
R111-S049-.01 CIT-7	1.68	5.008	0.008	123.540	5.559	66076%	7.093
R111-S049-.01 CIT-7-F	1.68	5.008	0.008	35.190	1.584	18822%	7.093

Fe Removed by Batch Shaker Method

SAMPLE #	Fe (mg/kg)	wt. of soil (g)	mg Fe in soil	Fe (mg/L)	mg Fe in sample	% Fe removed	pH of sample
R111-S049-.01 CIT-7-F/C	1.68	5.008	0.008	57.570	2.591	30792%	7.093
R111-S049-.01 CIT-7-F-DUP	1.68	5.008	0.008	31.880	1.435	17051%	7.093
R111-S037-.01 EDTA-3	980.36	5.008	4.910	29.480	1.327	27%	6.715
R111-S037-.01 EDTA-3-F	980.36	5.008	4.910	29.460	1.326	27%	6.715
R111-S037-.01 EDTA-3-F/C	975.68	5.008	4.886	28.860	1.299	27%	6.715
R111-S037-.01 EDTA-3-F-DUP	975.68	5.008	4.886	35.240	1.586	32%	6.715
R111-S037-.01 EDTA-5	975.68	5.007	4.885	11.040	0.497	10%	7.113
R111-S037-.01 EDTA-5-F	975.68	5.007	4.885	9.680	0.436	9%	7.113
R111-S037-.01 EDTA-5-F/C	975.68	5.007	4.885	10.030	0.451	9%	7.113
R111-S037-.01 EDTA-5-F-DUP	975.68	5.007	4.885	11.270	0.507	10%	7.113
R111-S037-.01 EDTA-7	975.68	5.010	4.888	8.350	0.376	8%	7.229
R111-S037-.01 EDTA-7-F	975.68	5.010	4.888	4.590	0.207	4%	7.229
R111-S037-.01 EDTA-7-F/C	975.68	5.010	4.888	4.830	0.217	4%	7.229
R111-S037-.01 EDTA-7-F-DUP	975.68	5.010	4.888	5.190	0.234	5%	7.229
R111-S038-.01 EDTA-3	1523.36	5.024	7.653	36.010	1.620	21%	6.884
R111-S038-.01 EDTA-3-F	1523.36	5.024	7.653	32.960	1.483	19%	6.884
R111-S038-.01 EDTA-3-F/C	1523.36	5.024	7.653	31.220	1.405	18%	6.884
R111-S038-.01 EDTA-3-F-DUP	1523.36	5.024	7.653	31.460	1.416	18%	6.884
R111-S038-.01 EDTA-5	1523.36	5.009	7.631	15.320	0.689	9%	6.982
R111-S038-.01 EDTA-5-F	1523.36	5.009	7.631	14.240	0.641	8%	6.982
R111-S038-.01 EDTA-5-F/C	1523.36	5.009	7.631	14.340	0.645	8%	6.982
R111-S038-.01 EDTA-5-F-DUP	1523.36	5.009	7.631	14.430	0.649	9%	6.982
R111-S038-.01 EDTA-7	1523.36	5.019	7.646	6.450	0.290	4%	7.204
R111-S038-.01 EDTA-7-F	1523.36	5.019	7.646	4.550	0.205	3%	7.204
R111-S038-.01 EDTA-7-F/C	1523.36	5.019	7.646	4.290	0.193	3%	7.204
R111-S038-.01 EDTA-7-F-DUP	1523.36	5.019	7.646	4.640	0.209	3%	7.204
R111-S039-.01 EDTA-3	662.09	5.026	3.328	130.090	5.854	176%	6.401
R111-S039-.01 EDTA-3-F	662.09	5.026	3.328	113.050	5.087	153%	6.401
R111-S039-.01 EDTA-3-F/C	662.09	5.026	3.328	113.400	5.103	153%	6.401
R111-S039-.01 EDTA-3-F-DUP	662.09	5.026	3.328	70.270	3.162	95%	6.401
R111-S039-.01 EDTA-5	662.09	5.041	3.338	15.140	0.681	20%	6.854
R111-S039-.01 EDTA-5-F	662.09	5.041	3.338	14.560	0.655	20%	6.854
R111-S039-.01 EDTA-5-F/C	662.09	5.041	3.338	14.550	0.655	20%	6.854
R111-S039-.01 EDTA-5-F-DUP	662.09	5.041	3.338	17.260	0.777	23%	6.854
R111-S039-.01 EDTA-7	662.09	5.031	3.331	5.580	0.251	8%	7.186

Fe Removed by Batch Shaker Method

SAMPLE #	Fe (mg/kg)	wt. of soil (g)	mg Fe in soil	Fe (mg/L)	mg Fe in sample	% Fe removed	pH of sample
R111-S039-.01 EDTA-7-F	662.09	5.031	3.331	4.630	0.208	6%	7.186
R111-S039-.01 EDTA-7-F/C	662.09	5.031	3.331	4.540	0.204	6%	7.186
R111-S039-.01 EDTA-7-F-DUP	662.09	5.031	3.331	5.250	0.236	7%	7.186
R111-S041-.01 EDTA-3	193.56	5.031	0.974	57.810	2.601	267%	6.214
R111-S041-.01 EDTA-3-F	193.56	5.031	0.974	57.250	2.576	265%	6.214
R111-S041-.01 EDTA-3-F/C	193.56	5.031	0.974	59.320	2.669	274%	6.214
R111-S041-.01 EDTA-3-F-DUP	193.56	5.031	0.974	32.510	1.463	150%	6.214
R111-S041-.01 EDTA-5	193.56	5.036	0.975	14.170	0.638	65%	6.887
R111-S041-.01 EDTA-5-F	193.56	5.036	0.975	16.470	0.741	76%	6.887
R111-S041-.01 EDTA-5-F/C	193.56	5.036	0.975	16.660	0.750	77%	6.887
R111-S041-.01 EDTA-5-F-DUP	193.56	5.036	0.975	17.600	0.792	81%	6.887
R111-S041-.01 EDTA-7	193.56	5.027	0.973	4.500	0.203	21%	7.431
R111-S041-.01 EDTA-7-F	193.56	5.027	0.973	2.920	0.131	14%	7.431
R111-S041-.01 EDTA-7-F/C	193.56	5.027	0.973	3.020	0.136	14%	7.431
R111-S041-.01 EDTA-7-F-DUP	193.56	5.027	0.973	3.360	0.151	16%	7.431
R111-S044-.01 EDTA-3	400.10	5.036	2.015	50.580	2.276	113%	6.701
R111-S044-.01 EDTA-3-F	400.10	5.036	2.015	68.240	3.071	152%	6.701
R111-S044-.01 EDTA-3-F/C	400.10	5.036	2.015	70.710	3.182	158%	6.701
R111-S044-.01 EDTA-3-F-DUP	400.10	5.036	2.015	62.230	2.800	139%	6.701
R111-S044-.01 EDTA-5	400.10	5.034	2.014	16.320	0.734	36%	6.321
R111-S044-.01 EDTA-5-F	400.10	5.034	2.014	21.300	0.959	48%	6.321
R111-S044-.01 EDTA-5-F/C	400.10	5.034	2.014	21.800	0.981	49%	6.321
R111-S044-.01 EDTA-5-F-DUP	400.10	5.034	2.014	21.370	0.962	48%	6.321
R111-S044-.01 EDTA-7	400.10	5.013	2.006	7.390	0.333	17%	7.847
R111-S044-.01 EDTA-7-F	400.10	5.013	2.006	7.470	0.336	17%	7.847
R111-S044-.01 EDTA-7-F/C	400.10	5.013	2.006	7.740	0.348	17%	7.847
R111-S044-.01 EDTA-7-F-DUP	400.10	5.013	2.006	7.630	0.343	17%	7.847
R111-S049-.01 EDTA-3	1.68	5.041	0.008	17.050	0.767	9060%	3.183
R111-S049-.01 EDTA-3-F	1.68	5.041	0.008	28.640	1.289	15218%	3.183
R111-S049-.01 EDTA-3-F/C	1.68	5.041	0.008	28.030	1.261	14894%	3.183
R111-S049-.01 EDTA-3-F-DUP	1.68	5.041	0.008	34.660	1.560	18417%	3.183
R111-S049-.01 EDTA-5	1.68	5.027	0.008	18.410	0.828	9810%	5.076
R111-S049-.01 EDTA-5-F	1.68	5.027	0.008	32.060	1.443	17083%	5.076
R111-S049-.01 EDTA-5-F/C	1.68	5.027	0.008	31.550	1.420	16811%	5.076
R111-S049-.01 EDTA-5-F-DUP	1.68	5.027	0.008	31.830	1.432	16960%	5.076

Fe Removed by Batch Shaker Method

SAMPLE #	Fe (mg/kg)	wt. of soil (g)	mg Fe in soil	Fe (mg/L)	mg Fe in sample	% Fe removed	pH of sample
R111-S049-.01 EDTA-7	1.68	5.033	0.008	103.700	4.667	55189%	7.101
R111-S049-.01 EDTA-7-F	1.68	5.033	0.008	28.510	1.283	15173%	7.101
R111-S049-.01 EDTA-7-F/C	1.68	5.033	0.008	30.440	1.370	16200%	7.101
R111-S049-.01 EDTA-7-F-DUP	1.68	5.033	0.008	28.620	1.288	15232%	7.101

Pb Removed by Batch Shaker Method

SAMPLE #	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pb in Sample (mg)	% Pb Removed	pH of Sample	Pb Remaining in Soil (mg/kg)
R111-S037-.01 CIT-3	12.45	5.003	0.062	1.170	0.053	85%	5.915	1.926
R111-S037-.01 CIT-3-F	12.45	5.003	0.062	0.260	0.012	19%	5.915	10.111
R111-S037-.01 CIT-3-F/C	12.45	5.003	0.062	0.380	0.017	27%	5.915	9.032
R111-S037-.01 CIT-3-F-DUP	12.45	5.003	0.062	0.390	0.018	28%	5.915	8.942
R111-S037-.01 CIT-5	12.45	5.010	0.062	0.520	0.023	38%	6.409	7.779
R111-S037-.01 CIT-5-F	12.45	5.010	0.062	0.260	0.012	19%	6.409	10.115
R111-S037-.01 CIT-5-F/C	12.45	5.010	0.062	0.250	0.011	18%	6.409	10.204
R111-S037-.01 CIT-5-F-DUP	12.45	5.010	0.062	0.250	0.011	18%	6.409	10.204
R111-S037-.01 CIT-7	12.45	5.036	0.063	1.570	0.071	113%	7.698	-1.579
R111-S037-.01 CIT-7-F	12.45	5.036	0.063	0.390	0.018	28%	7.698	8.965
R111-S037-.01 CIT-7-F/C	12.45	5.036	0.063	0.250	0.011	18%	7.698	10.216
R111-S037-.01 CIT-7-F-DUP	12.45	5.036	0.063	0.260	0.012	19%	7.698	10.127
R111-S038-.01 CIT-3	15.04	5.014	0.075	1.300	0.059	78%	6.237	3.373
R111-S038-.01 CIT-3-F	15.04	5.014	0.075	0.510	0.023	30%	6.237	10.463
R111-S038-.01 CIT-3-F/C	15.04	5.014	0.075	0.780	0.035	47%	6.237	8.040
R111-S038-.01 CIT-3-F-DUP	15.04	5.014	0.075	0.520	0.023	31%	6.237	10.373
R111-S038-.01 CIT-5	15.04	5.014	0.075	0.390	0.018	23%	6.736	11.540
R111-S038-.01 CIT-5-F	15.04	5.014	0.075	0.260	0.012	16%	6.736	12.707
R111-S038-.01 CIT-5-F/C	15.04	5.014	0.075	0.250	0.011	15%	6.736	12.796
R111-S038-.01 CIT-5-F-DUP	15.04	5.014	0.075	0.390	0.018	23%	6.736	11.540
R111-S038-.01 CIT-7	15.04	5.030	0.076	0.260	0.012	15%	7.734	12.714
R111-S038-.01 CIT-7-F	15.04	5.030	0.076	0.250	0.011	15%	7.734	12.803
R111-S038-.01 CIT-7-F/C	15.04	5.030	0.076	0.250	0.011	15%	7.734	12.803
R111-S038-.01 CIT-7-F-DUP	15.04	5.030	0.076	0.250	0.011	15%	7.734	12.803
R111-S039-.01 CIT-3	15.04	5.008	0.075	0.910	0.041	54%	6.304	6.863
R111-S039-.01 CIT-3-F	15.04	5.008	0.075	0.510	0.023	30%	6.304	10.457
R111-S039-.01 CIT-3-F/C	15.04	5.008	0.075	0.510	0.023	30%	6.304	10.457
R111-S039-.01 CIT-3-F-DUP	15.04	5.008	0.075	0.250	0.011	15%	6.304	12.794
R111-S039-.01 CIT-5	15.04	5.041	0.076	0.390	0.018	23%	6.321	11.559
R111-S039-.01 CIT-5-F	15.04	5.041	0.076	0.250	0.011	15%	6.321	12.808
R111-S039-.01 CIT-5-F/C	15.04	5.041	0.076	0.510	0.023	30%	6.321	10.487
R111-S039-.01 CIT-5-F-DUP	15.04	5.041	0.076	0.250	0.011	15%	6.321	12.808
R111-S039-.01 CIT-7	15.04	5.029	0.076	2.880	0.130	171%	7.421	-10.731
R111-S039-.01 CIT-7-F	15.04	5.029	0.076	0.770	0.035	46%	7.421	8.150
R111-S039-.01 CIT-7-F/C	15.04	5.029	0.076	0.640	0.029	38%	7.421	9.313

Pb Removed by Batch Shaker Method

SAMPLE #	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pb in Sample (mg)	% Pb Removed	pH of Sample	Pb Remaining in Soil (mg/kg)
R111-S039-.01 CIT-7-F-DUP	15.04	5.029	0.076	0.920	0.041	55%	7.421	6.808
R111-S041-.01 CIT-3	2.51	5.002	0.013	1.430	0.064	513%	5.861	-10.355
R111-S041-.01 CIT-3-F	2.51	5.002	0.013	0.900	0.041	323%	5.861	-5.587
R111-S041-.01 CIT-3-F/C	2.51	5.002	0.013	0.390	0.018	140%	5.861	-0.999
R111-S041-.01 CIT-3-F-DUP	2.51	5.002	0.013	0.650	0.029	233%	5.861	-3.338
R111-S041-.01 CIT-5	2.51	5.036	0.013	0.650	0.029	231%	6.498	-3.298
R111-S041-.01 CIT-5-F	2.51	5.036	0.013	0.260	0.012	93%	6.498	0.187
R111-S041-.01 CIT-5-F/C	2.51	5.036	0.013	0.250	0.011	89%	6.498	0.276
R111-S041-.01 CIT-5-F-DUP	2.51	5.036	0.013	0.250	0.011	89%	6.498	0.276
R111-S041-.01 CIT-7	2.51	5.041	0.013	3.000	0.135	1067%	7.601	-24.270
R111-S041-.01 CIT-7-F	2.51	5.041	0.013	0.380	0.017	135%	7.601	-0.882
R111-S041-.01 CIT-7-F/C	2.51	5.041	0.013	0.250	0.011	89%	7.601	0.278
R111-S041-.01 CIT-7-F-DUP	2.51	5.041	0.013	0.260	0.012	92%	7.601	0.189
R111-S044-.01 CIT-3	3.77	5.021	0.019	0.780	0.035	185%	6.432	-3.221
R111-S044-.01 CIT-3-F	3.77	5.021	0.019	0.260	0.012	62%	6.432	1.440
R111-S044-.01 CIT-3-F/C	3.77	5.021	0.019	0.250	0.011	59%	6.432	1.529
R111-S044-.01 CIT-3-F-DUP	3.77	5.021	0.019	0.250	0.011	59%	6.432	1.529
R111-S044-.01 CIT-5	3.77	5.021	0.019	0.260	0.012	62%	6.747	1.440
R111-S044-.01 CIT-5-F	3.77	5.021	0.019	0.390	0.018	93%	6.747	0.275
R111-S044-.01 CIT-5-F/C	3.77	5.021	0.019	0.250	0.011	59%	6.747	1.529
R111-S044-.01 CIT-5-F-DUP	3.77	5.021	0.019	0.260	0.012	62%	6.747	1.440
R111-S044-.01 CIT-7	3.77	5.041	0.019	1.820	0.082	431%	7.261	-12.477
R111-S044-.01 CIT-7-F	3.77	5.041	0.019	0.380	0.017	90%	7.261	0.378
R111-S044-.01 CIT-7-F/C	3.77	5.041	0.019	0.390	0.018	92%	7.261	0.289
R111-S044-.01 CIT-7-F-DUP	3.77	5.041	0.019	0.250	0.011	59%	7.261	1.538
R111-S049-.01 CIT-3	0.50	5.030	0.003	0.250	0.011	447%	3.257	-1.737
R111-S049-.01 CIT-3-F	0.50	5.030	0.003	0.260	0.012	465%	3.257	-1.826
R111-S049-.01 CIT-3-F/C	0.50	5.030	0.003	0.250	0.011	447%	3.257	-1.737
R111-S049-.01 CIT-3-F-DUP	0.50	5.030	0.003	0.250	0.011	447%	3.257	-1.737
R111-S049-.01 CIT-5	0.50	5.009	0.003	0.260	0.012	467%	5.163	-1.836
R111-S049-.01 CIT-5-F	0.50	5.009	0.003	0.250	0.011	449%	5.163	-1.746
R111-S049-.01 CIT-5-F/C	0.50	5.009	0.003	0.250	0.011	449%	5.163	-1.746
R111-S049-.01 CIT-5-F-DUP	0.50	5.009	0.003	0.250	0.011	449%	5.163	-1.746
R111-S049-.01 CIT-7	0.50	5.008	0.003	0.520	0.023	935%	7.093	-4.173
R111-S049-.01 CIT-7-F	0.50	5.008	0.003	0.250	0.011	449%	7.093	-1.746

Pb Removed by Batch Shaker Method

SAMPLE #	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pb in Sample (mg)	% Pb Removed	pH of Sample	Pb Remaining in Soil (mg/kg)
R111-S049-.01 CIT-7-F/C	0.50	5.008	0.003	0.390	0.018	701%	7.093	-3.004
R111-S049-.01 CIT-7-F-DUP	0.50	5.008	0.003	0.250	0.011	449%	7.093	-1.746
R111-S037-.01 EDTA-3	12.45	5.008	0.062	4.460	0.201	322%	6.715	-27.626
R111-S037-.01 EDTA-3-F	12.45	5.008	0.062	4.850	0.218	350%	6.715	-31.130
R111-S037-.01 EDTA-3-F/C	12.45	5.008	0.062	4.810	0.216	347%	6.715	-30.771
R111-S037-.01 EDTA-3-F-DUP	12.45	5.008	0.062	4.680	0.211	338%	6.715	-29.603
R111-S037-.01 EDTA-5	12.45	5.007	0.062	3.150	0.142	227%	7.113	-15.860
R111-S037-.01 EDTA-5-F	12.45	5.007	0.062	3.890	0.175	281%	7.113	-22.511
R111-S037-.01 EDTA-5-F/C	12.45	5.007	0.062	4.010	0.180	289%	7.113	-23.590
R111-S037-.01 EDTA-5-F-DUP	12.45	5.007	0.062	3.840	0.173	277%	7.113	-22.062
R111-S037-.01 EDTA-7	12.45	5.010	0.062	3.140	0.141	227%	7.229	-15.754
R111-S037-.01 EDTA-7-F	12.45	5.010	0.062	3.650	0.164	263%	7.229	-20.334
R111-S037-.01 EDTA-7-F/C	12.45	5.010	0.062	3.770	0.170	272%	7.229	-21.412
R111-S037-.01 EDTA-7-F-DUP	12.45	5.010	0.062	3.600	0.162	260%	7.229	-19.885
R111-S038-.01 EDTA-3	15.04	5.024	0.076	5.540	0.249	330%	6.884	-34.582
R111-S038-.01 EDTA-3-F	15.04	5.024	0.076	6.180	0.278	368%	6.884	-40.314
R111-S038-.01 EDTA-3-F/C	15.04	5.024	0.076	5.980	0.269	356%	6.884	-38.523
R111-S038-.01 EDTA-3-F-DUP	15.04	5.024	0.076	6.020	0.271	359%	6.884	-38.881
R111-S038-.01 EDTA-5	15.04	5.009	0.075	4.220	0.190	252%	6.982	-22.872
R111-S038-.01 EDTA-5-F	15.04	5.009	0.075	4.680	0.211	280%	6.982	-27.004
R111-S038-.01 EDTA-5-F/C	15.04	5.009	0.075	4.400	0.198	263%	6.982	-24.489
R111-S038-.01 EDTA-5-F-DUP	15.04	5.009	0.075	4.270	0.192	255%	6.982	-23.321
R111-S038-.01 EDTA-7	15.04	5.019	0.075	3.260	0.147	194%	7.204	-14.189
R111-S038-.01 EDTA-7-F	15.04	5.019	0.075	4.440	0.200	265%	7.204	-24.769
R111-S038-.01 EDTA-7-F/C	15.04	5.019	0.075	4.230	0.190	252%	7.204	-22.886
R111-S038-.01 EDTA-7-F-DUP	15.04	5.019	0.075	3.730	0.168	222%	7.204	-18.403
R111-S039-.01 EDTA-3	15.04	5.026	0.076	5.700	0.257	339%	6.401	-35.995
R111-S039-.01 EDTA-3-F	15.04	5.026	0.076	5.210	0.234	310%	6.401	-31.607
R111-S039-.01 EDTA-3-F/C	15.04	5.026	0.076	5.200	0.234	310%	6.401	-31.518
R111-S039-.01 EDTA-3-F-DUP	15.04	5.026	0.076	5.070	0.228	302%	6.401	-30.354
R111-S039-.01 EDTA-5	15.04	5.041	0.076	3.660	0.165	217%	6.854	-17.632
R111-S039-.01 EDTA-5-F	15.04	5.041	0.076	4.420	0.199	262%	6.854	-24.416
R111-S039-.01 EDTA-5-F/C	15.04	5.041	0.076	4.000	0.180	237%	6.854	-20.667
R111-S039-.01 EDTA-5-F-DUP	15.04	5.041	0.076	4.110	0.185	244%	6.854	-21.649
R111-S039-.01 EDTA-7	15.04	5.031	0.076	3.020	0.136	180%	7.186	-11.973

Pb Removed by Batch Shaker Method

SAMPLE #	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pb in Sample (mg)	% Pb Removed	pH of Sample	Pb Remaining in Soil (mg/kg)
R111-S039-.01 EDTA-7-F	15.04	5.031	0.076	3.790	0.171	225%	7.186	-18.860
R111-S039-.01 EDTA-7-F/C	15.04	5.031	0.076	3.920	0.176	233%	7.186	-20.023
R111-S039-.01 EDTA-7-F-DUP	15.04	5.031	0.076	3.730	0.168	222%	7.186	-18.323
R111-S041-.01 EDTA-3	2.51	5.031	0.013	4.640	0.209	1653%	6.214	-38.993
R111-S041-.01 EDTA-3-F	2.51	5.031	0.013	4.160	0.187	1482%	6.214	-34.699
R111-S041-.01 EDTA-3-F/C	2.51	5.031	0.013	4.410	0.198	1572%	6.214	-36.935
R111-S041-.01 EDTA-3-F-DUP	2.51	5.031	0.013	4.540	0.204	1618%	6.214	-38.098
R111-S041-.01 EDTA-5	2.51	5.036	0.013	3.940	0.177	1403%	6.887	-32.697
R111-S041-.01 EDTA-5-F	2.51	5.036	0.013	3.900	0.176	1388%	6.887	-32.339
R111-S041-.01 EDTA-5-F/C	2.51	5.036	0.013	3.870	0.174	1378%	6.887	-32.071
R111-S041-.01 EDTA-5-F-DUP	2.51	5.036	0.013	3.710	0.167	1321%	6.887	-30.641
R111-S041-.01 EDTA-7	2.51	5.027	0.013	2.490	0.112	888%	7.431	-19.780
R111-S041-.01 EDTA-7-F	2.51	5.027	0.013	3.770	0.170	1345%	7.431	-31.238
R111-S041-.01 EDTA-7-F/C	2.51	5.027	0.013	3.670	0.165	1309%	7.431	-30.343
R111-S041-.01 EDTA-7-F-DUP	2.51	5.027	0.013	3.470	0.156	1238%	7.431	-28.552
R111-S044-.01 EDTA-3	3.77	5.036	0.019	3.160	0.142	749%	6.701	-24.467
R111-S044-.01 EDTA-3-F	3.77	5.036	0.019	3.650	0.164	865%	6.701	-28.845
R111-S044-.01 EDTA-3-F/C	3.77	5.036	0.019	3.360	0.151	796%	6.701	-26.254
R111-S044-.01 EDTA-3-F-DUP	3.77	5.036	0.019	3.040	0.137	721%	6.701	-23.394
R111-S044-.01 EDTA-5	3.77	5.034	0.019	2.230	0.100	529%	6.321	-16.164
R111-S044-.01 EDTA-5-F	3.77	5.034	0.019	2.330	0.105	552%	6.321	-17.058
R111-S044-.01 EDTA-5-F/C	3.77	5.034	0.019	2.310	0.104	548%	6.321	-16.880
R111-S044-.01 EDTA-5-F-DUP	3.77	5.034	0.019	2.380	0.107	564%	6.321	-17.505
R111-S044-.01 EDTA-7	3.77	5.013	0.019	1.690	0.076	402%	7.847	-11.401
R111-S044-.01 EDTA-7-F	3.77	5.013	0.019	2.070	0.093	493%	7.847	-14.812
R111-S044-.01 EDTA-7-F/C	3.77	5.013	0.019	2.350	0.106	560%	7.847	-17.325
R111-S044-.01 EDTA-7-F-DUP	3.77	5.013	0.019	2.120	0.095	505%	7.847	-15.261
R111-S049-.01 EDTA-3	0.50	5.041	0.003	0.650	0.029	1160%	3.183	-5.302
R111-S049-.01 EDTA-3-F	0.50	5.041	0.003	0.640	0.029	1143%	3.183	-5.213
R111-S049-.01 EDTA-3-F/C	0.50	5.041	0.003	0.510	0.023	911%	3.183	-4.053
R111-S049-.01 EDTA-3-F-DUP	0.50	5.041	0.003	0.260	0.012	464%	3.183	-1.821
R111-S049-.01 EDTA-5	0.50	5.027	0.003	0.260	0.012	465%	5.076	-1.827
R111-S049-.01 EDTA-5-F	0.50	5.027	0.003	0.380	0.017	680%	5.076	-2.902
R111-S049-.01 EDTA-5-F/C	0.50	5.027	0.003	0.380	0.017	680%	5.076	-2.902
R111-S049-.01 EDTA-5-F-DUP	0.50	5.027	0.003	0.520	0.023	931%	5.076	-4.155

Pb Removed by Batch Shaker Method

SAMPLE #	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pb in Sample (mg)	% Pb Removed	pH of Sample	Pb Remaining in Soil (mg/kg)
R111-S049-.01 EDTA-7	0.50	5.033	0.003	0.780	0.035	1395%	7.101	-6.474
R111-S049-.01 EDTA-7-F	0.50	5.033	0.003	0.640	0.029	1144%	7.101	-5.222
R111-S049-.01 EDTA-7-F/C	0.50	5.033	0.003	0.390	0.018	697%	7.101	-2.987
R111-S049-.01 EDTA-7-F-DUP	0.50	5.033	0.003	0.530	0.024	948%	7.101	-4.239

Zn Removed by Batch Shaker Method

SAMPLE #	Zn (mg/kg)	Wt. of Soil (g)	Zn in Soil (mg)	Zn (mg/L)	Zn in Sample (mg)	% Zn Removed	pH of Sample	Zn Remaining in Soil (mg/kg)
R111-S037-.01 CIT-3	975.68	5.003	4.881	95.070	4.278	88%	5.915	120.563
R111-S037-.01 CIT-3-F	975.68	5.003	4.881	7.820	0.352	7%	5.915	905.342
R111-S037-.01 CIT-3-F/C	975.68	5.003	4.881	8.230	0.370	8%	5.915	901.654
R111-S037-.01 CIT-3-F-DUP	975.68	5.003	4.881	6.450	0.290	6%	5.915	917.665
R111-S037-.01 CIT-5	975.68	5.010	4.888	4.510	0.203	4%	6.409	935.171
R111-S037-.01 CIT-5-F	975.68	5.010	4.888	43.700	1.967	40%	6.409	583.165
R111-S037-.01 CIT-5-F/C	975.68	5.010	4.888	39.170	1.763	36%	6.409	623.854
R111-S037-.01 CIT-5-F-DUP	975.68	5.010	4.888	40.040	1.802	37%	6.409	616.039
R111-S037-.01 CIT-7	975.68	5.036	4.914	47.310	2.129	43%	7.698	552.934
R111-S037-.01 CIT-7-F	975.68	5.036	4.914	23.880	1.075	22%	7.698	762.296
R111-S037-.01 CIT-7-F/C	975.68	5.036	4.914	21.890	0.985	20%	7.698	780.078
R111-S037-.01 CIT-7-F-DUP	975.68	5.036	4.914	22.860	1.029	21%	7.698	771.411
R111-S038-.01 CIT-3	1523.36	5.014	7.638	13.160	0.592	8%	6.237	1405.251
R111-S038-.01 CIT-3-F	1523.36	5.014	7.638	10.570	0.476	6%	6.237	1428.496
R111-S038-.01 CIT-3-F/C	1523.36	5.014	7.638	15.840	0.713	9%	6.237	1381.198
R111-S038-.01 CIT-3-F-DUP	1523.36	5.014	7.638	10.980	0.494	6%	6.237	1424.816
R111-S038-.01 CIT-5	1523.36	5.014	7.638	30.540	1.374	18%	6.736	1249.267
R111-S038-.01 CIT-5-F	1523.36	5.014	7.638	5.540	0.249	3%	6.736	1473.639
R111-S038-.01 CIT-5-F/C	1523.36	5.014	7.638	5.010	0.225	3%	6.736	1478.396
R111-S038-.01 CIT-5-F-DUP	1523.36	5.014	7.638	5.680	0.256	3%	6.736	1472.383
R111-S038-.01 CIT-7	1523.36	5.030	7.663	32.640	1.469	19%	7.734	1231.352
R111-S038-.01 CIT-7-F	1523.36	5.030	7.663	20.510	0.923	12%	7.734	1339.871
R111-S038-.01 CIT-7-F/C	1523.36	5.030	7.663	19.910	0.896	12%	7.734	1345.239
R111-S038-.01 CIT-7-F-DUP	1523.36	5.030	7.663	19.680	0.886	12%	7.734	1347.296
R111-S039-.01 CIT-3	662.09	5.008	3.316	24.240	1.091	33%	6.304	444.278
R111-S039-.01 CIT-3-F	662.09	5.008	3.316	20.420	0.919	28%	6.304	478.604
R111-S039-.01 CIT-3-F/C	662.09	5.008	3.316	27.670	1.245	38%	6.304	413.458
R111-S039-.01 CIT-3-F-DUP	662.09	5.008	3.316	17.930	0.807	24%	6.304	500.978
R111-S039-.01 CIT-5	662.09	5.041	3.338	21.830	0.982	29%	6.321	467.218
R111-S039-.01 CIT-5-F	662.09	5.041	3.338	11.230	0.505	15%	6.321	561.842
R111-S039-.01 CIT-5-F/C	662.09	5.041	3.338	11.180	0.503	15%	6.321	562.288
R111-S039-.01 CIT-5-F-DUP	662.09	5.041	3.338	11.260	0.507	15%	6.321	561.574
R111-S039-.01 CIT-7	662.09	5.029	3.330	38.910	1.751	53%	7.421	313.919
R111-S039-.01 CIT-7-F	662.09	5.029	3.330	12.510	0.563	17%	7.421	550.149
R111-S039-.01 CIT-7-F/C	662.09	5.029	3.330	10.500	0.473	14%	7.421	568.135

Zn Removed by Batch Shaker Method

SAMPLE #	Zn (mg/kg)	Wt. of Soil (g)	Zn in Soil (mg)	Zn (mg/L)	Zn in Sample (mg)	% Zn Removed	pH of Sample	Zn Remaining in Soil (mg/kg)
R111-S039-.01 CIT-7-F-DUP	662.09	5.029	3.330	15.110	0.680	20%	7.421	526.884
R111-S041-.01 CIT-3	193.56	5.002	0.968	42.680	1.921	198%	5.861	-190.406
R111-S041-.01 CIT-3-F	193.56	5.002	0.968	30.810	1.386	143%	5.861	-83.619
R111-S041-.01 CIT-3-F/C	193.56	5.002	0.968	5.850	0.263	27%	5.861	140.931
R111-S041-.01 CIT-3-F-DUP	193.56	5.002	0.968	29.620	1.333	138%	5.861	-72.913
R111-S041-.01 CIT-5	193.56	5.036	0.975	17.030	0.766	79%	6.498	41.386
R111-S041-.01 CIT-5-F	193.56	5.036	0.975	8.260	0.372	38%	6.498	119.751
R111-S041-.01 CIT-5-F/C	193.56	5.036	0.975	7.280	0.328	34%	6.498	128.508
R111-S041-.01 CIT-5-F-DUP	193.56	5.036	0.975	7.040	0.317	33%	6.498	130.653
R111-S041-.01 CIT-7	193.56	5.041	0.976	40.820	1.837	188%	7.601	-170.832
R111-S041-.01 CIT-7-F	193.56	5.041	0.976	9.290	0.418	43%	7.601	110.630
R111-S041-.01 CIT-7-F/C	193.56	5.041	0.976	9.470	0.426	44%	7.601	109.023
R111-S041-.01 CIT-7-F-DUP	193.56	5.041	0.976	8.650	0.389	40%	7.601	116.343
R111-S044-.01 CIT-3	400.10	5.021	2.009	44.140	1.986	99%	6.432	4.502
R111-S044-.01 CIT-3-F	400.10	5.021	2.009	29.890	1.345	67%	6.432	132.215
R111-S044-.01 CIT-3-F/C	400.10	5.021	2.009	27.580	1.241	62%	6.432	152.918
R111-S044-.01 CIT-3-F-DUP	400.10	5.021	2.009	28.780	1.295	64%	6.432	142.163
R111-S044-.01 CIT-5	400.10	5.021	2.009	18.570	0.836	42%	6.747	233.669
R111-S044-.01 CIT-5-F	400.10	5.021	2.009	11.630	0.523	26%	6.747	295.868
R111-S044-.01 CIT-5-F/C	400.10	5.021	2.009	11.210	0.504	25%	6.747	299.632
R111-S044-.01 CIT-5-F-DUP	400.10	5.021	2.009	11.010	0.495	25%	6.747	301.424
R111-S044-.01 CIT-7	400.10	5.041	2.017	45.160	2.032	101%	7.261	-3.034
R111-S044-.01 CIT-7-F	400.10	5.041	2.017	13.060	0.588	29%	7.261	283.516
R111-S044-.01 CIT-7-F/C	400.10	5.041	2.017	45.360	2.041	101%	7.261	-4.820
R111-S044-.01 CIT-7-F-DUP	400.10	5.041	2.017	12.270	0.552	27%	7.261	290.568
R111-S049-.01 CIT-3	1.68	5.030	0.008	2.150	0.097	1145%	3.257	-17.555
R111-S049-.01 CIT-3-F	1.68	5.030	0.008	0.410	0.018	218%	3.257	-1.988
R111-S049-.01 CIT-3-F/C	1.68	5.030	0.008	0.540	0.024	288%	3.257	-3.151
R111-S049-.01 CIT-3-F-DUP	1.68	5.030	0.008	0.530	0.024	282%	3.257	-3.062
R111-S049-.01 CIT-5	1.68	5.009	0.008	3.150	0.142	1684%	5.163	-26.619
R111-S049-.01 CIT-5-F	1.68	5.009	0.008	0.460	0.021	246%	5.163	-2.453
R111-S049-.01 CIT-5-F/C	1.68	5.009	0.008	1.770	0.080	947%	5.163	-14.221
R111-S049-.01 CIT-5-F-DUP	1.68	5.009	0.008	0.430	0.019	230%	5.163	-2.183
R111-S049-.01 CIT-7	1.68	5.008	0.008	2.420	0.109	1294%	7.093	-20.065
R111-S049-.01 CIT-7-F	1.68	5.008	0.008	1.350	0.061	722%	7.093	-10.451

Zn Removed by Batch Shaker Method

SAMPLE #	Zn (mg/kg)	Wt. of Soil (g)	Zn in Soil (mg)	Zn (mg/L)	Zn in Sample (mg)	% Zn Removed	pH of Sample	Zn Remaining in Soil (mg/kg)
R111-S049-.01 CIT-7-F/C	1.68	5.008	0.008	7.520	0.338	4022%	7.093	-65.892
R111-S049-.01 CIT-7-F-DUP	1.68	5.008	0.008	2.560	0.115	1369%	7.093	-21.323
R111-S037-.01 EDTA-3	980.36	5.008	4.910	10.550	0.475	10%	6.715	885.562
R111-S037-.01 EDTA-3-F	980.36	5.008	4.910	12.470	0.561	11%	6.715	868.309
R111-S037-.01 EDTA-3-F/C	975.68	5.008	4.886	12.730	0.573	12%	6.715	861.293
R111-S037-.01 EDTA-3-F-DUP	975.68	5.008	4.886	12.350	0.556	11%	6.715	864.708
R111-S037-.01 EDTA-5	975.68	5.007	4.885	5.700	0.257	5%	7.113	924.452
R111-S037-.01 EDTA-5-F	975.68	5.007	4.885	8.300	0.374	8%	7.113	901.084
R111-S037-.01 EDTA-5-F/C	975.68	5.007	4.885	8.200	0.369	8%	7.113	901.983
R111-S037-.01 EDTA-5-F-DUP	975.68	5.007	4.885	8.660	0.390	8%	7.113	897.849
R111-S037-.01 EDTA-7	975.68	5.010	4.888	40.580	1.826	37%	7.229	611.189
R111-S037-.01 EDTA-7-F	975.68	5.010	4.888	7.030	0.316	6%	7.229	912.536
R111-S037-.01 EDTA-7-F/C	975.68	5.010	4.888	7.820	0.352	7%	7.229	905.440
R111-S037-.01 EDTA-7-F-DUP	975.68	5.010	4.888	6.940	0.312	6%	7.229	913.345
R111-S038-.01 EDTA-3	1523.36	5.024	7.653	13.220	0.595	8%	6.884	1404.948
R111-S038-.01 EDTA-3-F	1523.36	5.024	7.653	15.140	0.681	9%	6.884	1387.751
R111-S038-.01 EDTA-3-F/C	1523.36	5.024	7.653	15.220	0.685	9%	6.884	1387.034
R111-S038-.01 EDTA-3-F-DUP	1523.36	5.024	7.653	0.620	0.028	0%	6.884	1517.807
R111-S038-.01 EDTA-5	1523.36	5.009	7.631	8.340	0.375	5%	6.982	1448.435
R111-S038-.01 EDTA-5-F	1523.36	5.009	7.631	11.570	0.521	7%	6.982	1419.417
R111-S038-.01 EDTA-5-F/C	1523.36	5.009	7.631	117.790	5.301	69%	6.982	465.155
R111-S038-.01 EDTA-5-F-DUP	1523.36	5.009	7.631	11.460	0.516	7%	6.982	1420.405
R111-S038-.01 EDTA-7	1523.36	5.019	7.646	51.450	2.315	30%	7.204	1062.063
R111-S038-.01 EDTA-7-F	1523.36	5.019	7.646	94.920	4.271	56%	7.204	672.314
R111-S038-.01 EDTA-7-F/C	1523.36	5.019	7.646	58.710	2.642	35%	7.204	996.970
R111-S038-.01 EDTA-7-F-DUP	1523.36	5.019	7.646	86.950	3.913	51%	7.204	743.772
R111-S039-.01 EDTA-3	662.09	5.026	3.328	47.120	2.120	64%	6.401	240.204
R111-S039-.01 EDTA-3-F	662.09	5.026	3.328	51.980	2.339	70%	6.401	196.690
R111-S039-.01 EDTA-3-F/C	662.09	5.026	3.328	47.960	2.158	65%	6.401	232.683
R111-S039-.01 EDTA-3-F-DUP	662.09	5.026	3.328	48.620	2.188	66%	6.401	226.774
R111-S039-.01 EDTA-5	662.09	5.041	3.338	27.680	1.246	37%	6.854	414.996
R111-S039-.01 EDTA-5-F	662.09	5.041	3.338	36.130	1.626	49%	6.854	339.565
R111-S039-.01 EDTA-5-F/C	662.09	5.041	3.338	35.800	1.611	48%	6.854	342.511
R111-S039-.01 EDTA-5-F-DUP	662.09	5.041	3.338	36.380	1.637	49%	6.854	337.333
R111-S039-.01 EDTA-7	662.09	5.031	3.331	20.760	0.934	28%	7.186	476.401

Zn Removed by Batch Shaker Method

SAMPLE #	Zn (mg/kg)	Wt. of Soil (g)	Zn in Soil (mg)	Zn (mg/L)	Zn in Sample (mg)	% Zn Removed	pH of Sample	Zn Remaining in Soil (mg/kg)
R111-S039-.01 EDTA-7-F	662.09	5.031	3.331	29.760	1.339	40%	7.186	395.900
R111-S039-.01 EDTA-7-F/C	662.09	5.031	3.331	31.480	1.417	43%	7.186	380.516
R111-S039-.01 EDTA-7-F-DUP	662.09	5.031	3.331	30.550	1.375	41%	7.186	388.834
R111-S041-.01 EDTA-3	193.56	5.031	0.974	42.460	1.911	196%	6.214	-186.225
R111-S041-.01 EDTA-3-F	193.56	5.031	0.974	45.090	2.029	208%	6.214	-209.749
R111-S041-.01 EDTA-3-F/C	193.56	5.031	0.974	44.160	1.987	204%	6.214	-201.431
R111-S041-.01 EDTA-3-F-DUP	193.56	5.031	0.974	46.110	2.075	213%	6.214	-218.873
R111-S041-.01 EDTA-5	193.56	5.036	0.975	21.420	0.964	99%	6.887	2.158
R111-S041-.01 EDTA-5-F	193.56	5.036	0.975	35.150	1.582	162%	6.887	-120.529
R111-S041-.01 EDTA-5-F/C	193.56	5.036	0.975	36.680	1.651	169%	6.887	-134.200
R111-S041-.01 EDTA-5-F-DUP	193.56	5.036	0.975	37.430	1.684	173%	6.887	-140.902
R111-S041-.01 EDTA-7	193.56	5.027	0.973	18.130	0.816	84%	7.431	31.266
R111-S041-.01 EDTA-7-F	193.56	5.027	0.973	28.370	1.277	131%	7.431	-60.399
R111-S041-.01 EDTA-7-F/C	193.56	5.027	0.973	27.990	1.260	129%	7.431	-56.997
R111-S041-.01 EDTA-7-F-DUP	193.56	5.027	0.973	28.890	1.300	134%	7.431	-65.053
R111-S044-.01 EDTA-3	400.10	5.036	2.015	48.030	2.161	107%	6.701	-29.080
R111-S044-.01 EDTA-3-F	400.10	5.036	2.015	69.820	3.142	156%	6.701	-223.788
R111-S044-.01 EDTA-3-F/C	400.10	5.036	2.015	65.230	2.935	146%	6.701	-182.773
R111-S044-.01 EDTA-3-F-DUP	400.10	5.036	2.015	61.580	2.771	138%	6.701	-150.158
R111-S044-.01 EDTA-5	400.10	5.034	2.014	37.060	1.668	83%	6.321	68.813
R111-S044-.01 EDTA-5-F	400.10	5.034	2.014	41.660	1.875	93%	6.321	27.692
R111-S044-.01 EDTA-5-F/C	400.10	5.034	2.014	41.440	1.865	93%	6.321	29.659
R111-S044-.01 EDTA-5-F-DUP	400.10	5.034	2.014	41.650	1.874	93%	6.321	27.782
R111-S044-.01 EDTA-7	400.10	5.013	2.006	20.840	0.938	47%	7.847	213.026
R111-S044-.01 EDTA-7-F	400.10	5.013	2.006	32.110	1.445	72%	7.847	111.859
R111-S044-.01 EDTA-7-F/C	400.10	5.013	2.006	35.270	1.587	79%	7.847	83.493
R111-S044-.01 EDTA-7-F-DUP	400.10	5.013	2.006	32.880	1.480	74%	7.847	104.947
R111-S049-.01 EDTA-3	1.68	5.041	0.008	0.610	0.027	324%	3.183	-3.765
R111-S049-.01 EDTA-3-F	1.68	5.041	0.008	2.100	0.095	1116%	3.183	-17.066
R111-S049-.01 EDTA-3-F/C	1.68	5.041	0.008	2.400	0.108	1275%	3.183	-19.744
R111-S049-.01 EDTA-3-F-DUP	1.68	5.041	0.008	0.620	0.028	329%	3.183	-3.855
R111-S049-.01 EDTA-5	1.68	5.027	0.008	1.040	0.047	554%	5.076	-7.630
R111-S049-.01 EDTA-5-F	1.68	5.027	0.008	1.360	0.061	725%	5.076	-10.494
R111-S049-.01 EDTA-5-F/C	1.68	5.027	0.008	1.150	0.052	613%	5.076	-8.614
R111-S049-.01 EDTA-5-F-DUP	1.68	5.027	0.008	1.010	0.045	538%	5.076	-7.361

Zn Removed by Batch Shaker Method

SAMPLE #	Zn (mg/kg)	Wt. of Soil (g)	Zn in Soil (mg)	Zn (mg/L)	Zn in Sample (mg)	% Zn Removed	pH of Sample	Zn Remaining in Soil (mg/kg)
R111-S049-.01 EDTA-7	1.68	5.033	0.008	2.540	0.114	1352%	7.101	-21.030
R111-S049-.01 EDTA-7-F	1.68	5.033	0.008	2.840	0.128	1511%	7.101	-23.712
R111-S049-.01 EDTA-7-F/C	1.68	5.033	0.008	5.810	0.261	3092%	7.101	-50.267
R111-S049-.01 EDTA-7-F-DUP	1.68	5.033	0.008	0.680	0.031	362%	7.101	-4.400

Ba, Cd, Cr, Cu, Pb, Zn Removed by Batch Shaker Method

SAMPLE #	pH of Sample	% Ba Removed	% Cd Removed	% Cr Removed	% Cu Removed	% Pb Removed	% Zn Removed
R111-S037-.01 CIT-3	5.915	26%	32%	70%	437%	85%	88%
R111-S037-.01 CIT-3-F	5.915	72%	21%	70%	403%	19%	7%
R111-S037-.01 CIT-3-F/C	5.915	79%	20%	70%	406%	27%	8%
R111-S037-.01 CIT-3-F-DUP	5.915	75%	22%	70%	398%	28%	6%
R111-S037-.01 CIT-5	6.409	42%	18%	70%	320%	38%	4%
R111-S037-.01 CIT-5-F	6.409	37%	9%	70%	225%	19%	40%
R111-S037-.01 CIT-5-F/C	6.409	35%	10%	70%	220%	18%	36%
R111-S037-.01 CIT-5-F-DUP	6.409	30%	10%	70%	229%	18%	37%
R111-S037-.01 CIT-7	7.698	37%	10%	69%	341%	113%	43%
R111-S037-.01 CIT-7-F	7.698	28%	4%	69%	249%	28%	22%
R111-S037-.01 CIT-7-F/C	7.698	30%	3%	69%	245%	18%	20%
R111-S037-.01 CIT-7-F-DUP	7.698	24%	3%	69%	257%	19%	21%
R111-S038-.01 CIT-3	6.237	93%	45%	70%	444%	78%	8%
R111-S038-.01 CIT-3-F	6.237	87%	30%	70%	306%	30%	6%
R111-S038-.01 CIT-3-F/C	6.237	107%	31%	70%	306%	47%	9%
R111-S038-.01 CIT-3-F-DUP	6.237	89%	34%	70%	322%	31%	6%
R111-S038-.01 CIT-5	6.736	41%	23%	70%	302%	23%	18%
R111-S038-.01 CIT-5-F	6.736	46%	14%	70%	269%	16%	3%
R111-S038-.01 CIT-5-F/C	6.736	49%	14%	70%	256%	15%	3%
R111-S038-.01 CIT-5-F-DUP	6.736	39%	14%	70%	263%	23%	3%
R111-S038-.01 CIT-7	7.734	36%	6%	69%	215%	15%	19%
R111-S038-.01 CIT-7-F	7.734	36%	3%	69%	197%	15%	12%
R111-S038-.01 CIT-7-F/C	7.734	37%	2%	69%	193%	15%	12%
R111-S038-.01 CIT-7-F-DUP	7.734	33%	2%	69%	195%	15%	12%
R111-S039-.01 CIT-3	6.304	61%	79%	70%	150%	54%	33%
R111-S039-.01 CIT-3-F	6.304	63%	60%	70%	142%	30%	28%
R111-S039-.01 CIT-3-F/C	6.304	67%	60%	70%	143%	30%	38%
R111-S039-.01 CIT-3-F-DUP	6.304	61%	65%	70%	143%	15%	24%
R111-S039-.01 CIT-5	6.321	34%	64%	69%	113%	23%	29%
R111-S039-.01 CIT-5-F	6.321	36%	42%	69%	120%	15%	15%
R111-S039-.01 CIT-5-F/C	6.321	40%	42%	69%	119%	30%	15%
R111-S039-.01 CIT-5-F-DUP	6.321	36%	45%	69%	124%	15%	15%
R111-S039-.01 CIT-7	7.421	34%	50%	125%	189%	117%	53%
R111-S039-.01 CIT-7-F	7.421	29%	23%	69%	116%	46%	17%
R111-S039-.01 CIT-7-F/C	7.421	30%	21%	69%	111%	38%	14%

Ba, Cd, Cr, Cu, Pb, Zn Removed by Batch Shaker Method

SAMPLE #	pH of Sample	% Ba Removed	% Cd Removed	% Cr Removed	% Cu Removed	% Pb Removed	% Zn Removed
R111-S039-01 CIT-7-F-DUP	7.421	25%	24%	79%	126%	55%	20%
R111-S041-01 CIT-3	5.861	145%	117%	150%	9080%	513%	198%
R111-S041-01 CIT-3-F	5.861	135%	90%	150%	8662%	323%	143%
R111-S041-01 CIT-3-F/C	5.861	154%	94%	170%	840%	140%	27%
R111-S041-01 CIT-3-F-DUP	5.861	122%	97%	220%	861%	233%	138%
R111-S041-01 CIT-5	6.498	61%	66%	149%	468%	231%	79%
R111-S041-01 CIT-5-F	6.498	29%	20%	149%	307%	93%	38%
R111-S041-01 CIT-5-F/C	6.498	33%	21%	149%	303%	89%	34%
R111-S041-01 CIT-5-F-DUP	6.498	28%	21%	149%	302%	89%	33%
R111-S041-01 CIT-7	7.601	54%	75%	238%	9508%	1067%	188%
R111-S041-01 CIT-7-F	7.601	29%	23%	149%	470%	135%	43%
R111-S041-01 CIT-7-F/C	7.601	27%	24%	149%	431%	89%	44%
R111-S041-01 CIT-7-F-DUP	7.601	23%	21%	149%	454%	92%	40%
R111-S044-01 CIT-3	6.432	89%	59%	149%	1029%	185%	99%
R111-S044-01 CIT-3-F	6.432	74%	30%	149%	776%	62%	67%
R111-S044-01 CIT-3-F/C	6.432	85%	32%	149%	755%	59%	62%
R111-S044-01 CIT-3-F-DUP	6.432	73%	33%	149%	771%	59%	64%
R111-S044-01 CIT-5	6.747	36%	21%	149%	459%	62%	42%
R111-S044-01 CIT-5-F	6.747	39%	10%	149%	462%	93%	26%
R111-S044-01 CIT-5-F/C	6.747	38%	10%	149%	440%	59%	25%
R111-S044-01 CIT-5-F-DUP	6.747	36%	10%	149%	459%	62%	25%
R111-S044-01 CIT-7	7.261	42%	41%	159%	1225%	431%	101%
R111-S044-01 CIT-7-F	7.261	19%	18%	149%	631%	90%	29%
R111-S044-01 CIT-7-F/C	7.261	57%	19%	149%	579%	92%	101%
R111-S044-01 CIT-7-F-DUP	7.261	18%	17%	149%	603%	59%	29%
R111-S049-01 CIT-3	3.257	18%	118%	149%	119%	447%	1145%
R111-S049-01 CIT-3-F	3.257	12%	118%	149%	155%	465%	218%
R111-S049-01 CIT-3-F/C	3.257	19%	118%	149%	143%	447%	288%
R111-S049-01 CIT-3-F-DUP	3.257	11%	118%	149%	119%	447%	282%
R111-S049-01 CIT-5	5.163	26%	118%	150%	299%	467%	1684%
R111-S049-01 CIT-5-F	5.163	11%	118%	150%	132%	449%	246%
R111-S049-01 CIT-5-F/C	5.163	11%	118%	150%	144%	449%	947%
R111-S049-01 CIT-5-F-DUP	5.163	11%	118%	150%	156%	449%	230%
R111-S049-01 CIT-7	7.093	39%	118%	150%	300%	935%	1294%
R111-S049-01 CIT-7-F	7.093	60%	118%	150%	204%	449%	722%

Ba, Cd, Cr, Cu, Pb, Zn Removed by Batch Shaker Method

SAMPLE #	pH of Sample	% Ba Removed	% Cd Removed	% Cr Removed	% Cu Removed	% Pb Removed	% Zn Removed
R111-S049-.01 CIT-7-F-DUP	7.093	21%	118%	150%	192%	449%	1369%
R111-S049-.01 CIT-7-F/C	7.093	2747%	118%	150%	300%	701%	4022%
AVERAGE CITRIC ACID REMOVAL (of f/c samples)		52%	42%	111%	329%	131%	123%
pH 3 AVERAGE REMOVAL*		85%	59%	113%	432%	125%	72%
pH 5 AVERAGE REMOVAL*		34%	36%	110%	247%	110%	179%
pH 7 AVERAGE REMOVAL*		36%	31%	109%	309%	159%	38%
*not including S049 sample							
R111-S037-.01 EDTA-3	6.715	88%	48%	70%	548%	322%	10%
R111-S037-.01 EDTA-3-F	6.715	73%	45%	70%	603%	350%	11%
R111-S037-.01 EDTA-3-F/C	6.715	75%	48%	70%	575%	347%	12%
R111-S037-.01 EDTA-3-F-DUP	6.715	71%	47%	70%	590%	338%	11%
R111-S037-.01 EDTA-5	7.113	39%	41%	70%	434%	227%	5%
R111-S037-.01 EDTA-5-F	7.113	36%	45%	70%	687%	281%	8%
R111-S037-.01 EDTA-5-F/C	7.113	35%	48%	70%	6538%	289%	8%
R111-S037-.01 EDTA-5-F-DUP	7.113	36%	50%	70%	700%	277%	8%
R111-S037-.01 EDTA-7	7.229	35%	28%	70%	316%	227%	37%
R111-S037-.01 EDTA-7-F	7.229	28%	29%	70%	430%	263%	6%
R111-S037-.01 EDTA-7-F/C	7.229	37%	29%	70%	439%	272%	7%
R111-S037-.01 EDTA-7-F-DUP	7.229	27%	29%	70%	477%	260%	6%
R111-S038-.01 EDTA-3	6.884	87%	63%	69%	516%	330%	8%
R111-S038-.01 EDTA-3-F	6.884	78%	61%	69%	6154%	368%	9%
R111-S038-.01 EDTA-3-F/C	6.884	78%	57%	69%	6110%	356%	9%
R111-S038-.01 EDTA-3-F-DUP	6.884	72%	61%	69%	6216%	359%	0%
R111-S038-.01 EDTA-5	6.982	44%	41%	70%	357%	252%	5%
R111-S038-.01 EDTA-5-F	6.982	43%	42%	70%	480%	280%	7%
R111-S038-.01 EDTA-5-F/C	6.982	43%	41%	70%	464%	263%	69%
R111-S038-.01 EDTA-5-F-DUP	6.982	36%	46%	70%	469%	255%	7%
R111-S038-.01 EDTA-7	7.204	35%	33%	70%	271%	194%	30%
R111-S038-.01 EDTA-7-F	7.204	30%	37%	70%	397%	265%	56%
R111-S038-.01 EDTA-7-F/C	7.204	24%	41%	70%	398%	252%	35%
R111-S038-.01 EDTA-7-F-DUP	7.204	26%	36%	70%	397%	222%	51%
R111-S039-.01 EDTA-3	6.401	118%	100%	69%	2374%	339%	64%
R111-S039-.01 EDTA-3-F	6.401	86%	96%	69%	2543%	310%	70%

Ba, Cd, Cr, Cu, Pb, Zn Removed by Batch Shaker Method

SAMPLE #	pH of Sample	% Ba Removed	% Cd Removed	% Cr Removed	% Cu Removed	% Pb Removed	% Zn Removed
R111-S039-.01 EDTA-3-F/C	6.401	119%	99%	69%	2411%	310%	65%
R111-S039-.01 EDTA-3-F-DUP	6.401	95%	104%	69%	2514%	302%	66%
R111-S039-.01 EDTA-5	6.854	49%	86%	69%	144%	217%	37%
R111-S039-.01 EDTA-5-F	6.854	40%	84%	69%	191%	262%	49%
R111-S039-.01 EDTA-5-F/C	6.854	47%	87%	69%	1915%	237%	48%
R111-S039-.01 EDTA-5-F-DUP	6.854	40%	94%	69%	195%	244%	49%
R111-S039-.01 EDTA-7	7.186	31%	77%	69%	116%	180%	28%
R111-S039-.01 EDTA-7-F	7.186	40%	85%	69%	170%	225%	40%
R111-S039-.01 EDTA-7-F/C	7.186	39%	79%	69%	170%	233%	43%
R111-S039-.01 EDTA-7-F-DUP	7.186	29%	78%	69%	171%	222%	41%
R111-S041-.01 EDTA-3	6.214	102%	136%	149%	9273%	1653%	196%
R111-S041-.01 EDTA-3-F	6.214	108%	122%	149%	10199%	1482%	208%
R111-S041-.01 EDTA-3-F/C	6.214	105%	126%	149%	9764%	1572%	204%
R111-S041-.01 EDTA-3-F-DUP	6.214	96%	129%	149%	1017%	1618%	213%
R111-S041-.01 EDTA-5	6.887	63%	101%	149%	634%	1403%	99%
R111-S041-.01 EDTA-5-F	6.887	65%	101%	149%	8329%	1388%	162%
R111-S041-.01 EDTA-5-F/C	6.887	66%	109%	149%	804%	1378%	169%
R111-S041-.01 EDTA-5-F-DUP	6.887	60%	112%	149%	847%	1321%	173%
R111-S041-.01 EDTA-7	7.431	37%	98%	149%	481%	888%	84%
R111-S041-.01 EDTA-7-F	7.431	43%	94%	149%	725%	1345%	131%
R111-S041-.01 EDTA-7-F/C	7.431	43%	28%	149%	706%	1309%	129%
R111-S041-.01 EDTA-7-F-DUP	7.431	36%	100%	149%	724%	1238%	134%
R111-S044-.01 EDTA-3	6.701	79%	81%	149%	1290%	749%	107%
R111-S044-.01 EDTA-3-F	6.701	89%	78%	149%	1293%	865%	156%
R111-S044-.01 EDTA-3-F/C	6.701	85%	83%	149%	1224%	796%	146%
R111-S044-.01 EDTA-3-F-DUP	6.701	86%	86%	149%	1318%	721%	138%
R111-S044-.01 EDTA-5	6.321	53%	55%	149%	940%	529%	83%
R111-S044-.01 EDTA-5-F	6.321	67%	53%	149%	1319%	552%	93%
R111-S044-.01 EDTA-5-F/C	6.321	58%	55%	149%	1243%	548%	93%
R111-S044-.01 EDTA-5-F-DUP	6.321	54%	55%	149%	1302%	564%	93%
R111-S044-.01 EDTA-7	7.847	39%	37%	150%	597%	402%	47%
R111-S044-.01 EDTA-7-F	7.847	44%	45%	150%	865%	493%	72%
R111-S044-.01 EDTA-7-F/C	7.847	41%	45%	150%	845%	560%	79%
R111-S044-.01 EDTA-7-F-DUP	7.847	33%	42%	150%	851%	505%	74%
R111-S049-.01 EDTA-3	3.183	11%	117%	149%	226%	1160%	324%

Ba, Cd, Cr, Cu, Pb, Zn Removed by Batch Shaker Method

SAMPLE #	pH of Sample	% Ba Removed	% Cd Removed	% Cr Removed	% Cu Removed	% Pb Removed	% Zn Removed
R111-S049-.01 EDTA-3-F	3.183	12%	117%	149%	274%	1143%	1116%
R111-S049-.01 EDTA-3-F/C	3.183	25%	117%	149%	262%	911%	1275%
R111-S049-.01 EDTA-3-F-DUP	3.183	11%	117%	149%	298%	464%	329%
R111-S049-.01 EDTA-5	5.076	14%	118%	149%	191%	465%	554%
R111-S049-.01 EDTA-5-F	5.076	13%	118%	149%	275%	680%	725%
R111-S049-.01 EDTA-5-F/C	5.076	11%	118%	149%	275%	680%	613%
R111-S049-.01 EDTA-5-F-DUP	5.076	11%	118%	149%	286%	931%	538%
R111-S049-.01 EDTA-7	7.101	94%	118%	149%	274%	1395%	1352%
R111-S049-.01 EDTA-7-F	7.101	96%	118%	149%	262%	1144%	1511%
R111-S049-.01 EDTA-7-F/C	7.101	137%	118%	149%	310%	697%	3092%
R111-S049-.01 EDTA-7-F-DUP	7.101	50%	118%	149%	298%	948%	362%
AVERAGE EDTA REMOVAL*		59%	74%	109%	2243%	638%	74%
(of f/c samples)							
pH 3 AVERAGE REMOVAL*		81%	88%	109%	4017%	849%	87%
pH 5 AVERAGE REMOVAL*		43%	76%	109%	2193%	543%	78%
pH 7 AVERAGE REMOVAL*		54%	57%	110%	519%	523%	58%

BATCH SHAKER METHOD						
	Ba	Cd	Cr	Cu	Pb	Zn
AVERAGE .01M CITRIC ACID REMOVAL*	52%	42%	111%	329%	131%	123%
(of f/c samples)						
pH 3 AVERAGE REMOVAL*	85%	59%	113%	432%	125%	72%
pH 5 AVERAGE REMOVAL*	34%	36%	110%	247%	110%	179%
pH 7 AVERAGE REMOVAL*	36%	31%	109%	309%	159%	38%
*not including S049 sample						
AVERAGE .01M EDTA REMOVAL*	59%	74%	116%	2243%	638%	74%
(of f/c samples)						
pH 3 AVERAGE REMOVAL*	81%	88%	109%	4017%	849%	87%
pH 5 AVERAGE REMOVAL*	43%	76%	109%	2193%	543%	78%
pH 7 AVERAGE REMOVAL*	54%	57%	110%	519%	523%	58%
*not including S049 sample						
COLUMNAR FLOODING METHOD						
	Cd	Cr	Cu	Fe	Pb	Zn
AVERAGE DISTILLED WATER REMOVAL	3.72%	1.60%	0.21%	0.03%	0.31%	1.69%
AVERAGE CITRIC ACID REMOVAL	11.06%	2.37%	8.96%	0.39%	4.25%	10.59%
AVERAGE EDTA REMOVAL	13.00%	2.80%	1.41%	0.51%	17.61%	4.87%

Appendix B:

**Amount of Heavy Metals Removed by
Columnar Flooding: Cd, Cr, Cu, Fe, Pb, and Zn**

Cd Removed by Columnar Flooding

SAMPLE	Cd (mg/kg)	Wt. of Soil (g)	Cd in Soil (mg)	Cd (mg/L)	Pore Volume (mL)	Cd in Sample (mg)	% Cd Removed
R111-2 Composite Pore#1 .05M CIT(5)	53.413	188.124	10.048	0.14	38.280	0.005	0.05%
R111-2 Composite Pore#2 .05M CIT(5)	53.413	188.124	10.048	0.79	38.280	0.030	0.30%
R111-2 Composite Pore#3 .05M CIT(5)	53.413	188.124	10.048	0.59	38.280	0.023	0.22%
R111-2 Composite Pore#4 .05M CIT(5)	53.413	188.124	10.048	0.39	38.280	0.015	0.15%
R111-2 Composite Pore#5 .05M CIT(5)	53.413	188.124	10.048	0.34	38.280	0.013	0.13%
R111-2 Composite Pore#6 .05M CIT(5)	53.413	188.124	10.048	0.22	38.280	0.008	0.08%
R111-2 Composite Pore#7 .05M CIT(5)	53.413	188.124	10.048	0.14	38.280	0.005	0.05%
R111-2 Composite Pore#8 .05M CIT(5)	53.413	188.124	10.048	0.08	38.280	0.003	0.03%
R111-2 Composite Composite .05M CIT(5)	53.413	188.124	10.048	0.41	38.280	0.016	0.16%
R111-2 Composite Drainage .05M CIT(5)	53.413	188.124	10.048	0.43	38.280	0.016	0.16%
R111-2 Composite Pore#1 Dist. H2O(5)	53.413	188.124	10.048	0.05	38.280	0.002	0.02%
R111-2 Composite Pore#2 Dist. H2O(5)	53.413	188.124	10.048	0.05	38.280	0.002	0.02%
R111-2 Composite Pore#3 Dist. H2O(5)	53.413	188.124	10.048	0.05	38.280	0.002	0.02%
R111-2 Composite Pore#4 Dist. H2O(5)	53.413	188.124	10.048	0.05	38.280	0.002	0.02%
R111-2 Composite Pore#5 Dist. H2O(5)	53.413	188.124	10.048	0.05	38.280	0.002	0.02%
R111-2 Composite Drainage Dist. H2O(5)	53.413	188.124	10.048	0.05	38.280	0.002	0.02%
R111-2 Composite Composite Dist. H2O(5)	53.413	188.124	10.048	0.05	38.280	0.002	0.02%
R111-3 Composite Pore#1 .05M CIT(5)	14.196	310.567	4.409	0.05	87.720	0.004	0.10%
R111-3 Composite Pore#2 .05M CIT(5)	14.196	310.567	4.409	0.11	87.720	0.010	0.22%
R111-3 Composite Pore#3 .05M CIT(5)	14.196	310.567	4.409	0.44	87.720	0.039	0.88%
R111-3 Composite Pore#4 .05M CIT(5)	14.196	310.567	4.409	0.82	87.720	0.072	1.63%
R111-3 Composite Pore#5 .05M CIT(5)	14.196	310.567	4.409	0.87	87.720	0.076	1.73%
R111-3 Composite Pore#6 .05M CIT(5)	14.196	310.567	4.409	0.12	87.720	0.011	0.24%
R111-3 Composite Pore#7 .05M CIT(5)	14.196	310.567	4.409	0.08	87.720	0.007	0.16%
R111-3 Composite Drainage .05M CIT(5)	14.196	310.567	4.409	0.55	87.720	0.048	1.09%
R111-3 Composite Composite .05M CIT(5)	14.196	310.567	4.409	0.49	87.720	0.043	0.97%
R111-3 Composite Pore#1 Dist. H2O(5)	14.196	310.567	4.409	0.05	87.840	0.004	0.10%
R111-3 Composite Pore#2 Dist. H2O(5)	14.196	310.567	4.409	0.05	87.840	0.004	0.10%
R111-3 Composite Pore#3 Dist. H2O(5)	14.196	310.567	4.409	0.05	87.840	0.004	0.10%
R111-3 Composite Pore#4 Dist. H2O(5)	14.196	310.567	4.409	0.05	87.840	0.004	0.10%
R111-3 Composite Pore#5 Dist. H2O(5)	14.196	310.567	4.409	0.05	87.840	0.004	0.10%
R111-3 Composite Drainage Dist. H2O(5)	14.196	310.567	4.409	0.05	87.840	0.004	0.10%
R111-3 Composite Composite Dist. H2O(5)	14.196	310.567	4.409	0.05	87.840	0.004	0.10%

Cd Removed by Columnar Flooding

SAMPLE	Cd (mg/kg)	Wt. of Soil (g)	Cd in Soil (mg)	Cd (mg/L)	Pore Volume (mL)	Cd in Sample (mg)	% Cd Removed
R111-4 Composite Pore#1 .05M CIT(5)	24.392	206.100	5.027	0.11	53.550	0.006	0.12%
R111-4 Composite Pore#2 .05M CIT(5)	24.392	206.100	5.027	0.37	53.550	0.020	0.39%
R111-4 Composite Pore#3 .05M CIT(5)	24.392	206.100	5.027	0.3	53.550	0.016	0.32%
R111-4 Composite Pore#4 .05M CIT(5)	24.392	206.100	5.027	0.11	53.550	0.006	0.12%
R111-4 Composite Pore#5 .05M CIT(5)	24.392	206.100	5.027	0.05	53.550	0.003	0.05%
R111-4 Composite Pore#6 .05M CIT(5)	24.392	206.100	5.027	0.05	53.550	0.003	0.05%
R111-4 Composite Pore#7 .05M CIT(5)	24.392	206.100	5.027	0.05	53.550	0.003	0.05%
R111-4 Composite Pore#8 .05M CIT(5)	24.392	206.100	5.027	0.05	53.550	0.003	0.05%
R111-4 Composite Drainage .05M CIT(5)	24.392	206.100	5.027	0.05	53.550	0.003	0.05%
R111-4 Composite Composite .05M CIT(5)	24.392	206.100	5.027	0.06	53.550	0.003	0.06%
R111-4 Composite Pore#1 Dist. H20(5)	24.392	206.100	5.027	0.05	53.770	0.003	0.05%
R111-4 Composite Pore#2 Dist. H20(5)	24.392	206.100	5.027	0.05	53.770	0.003	0.05%
R111-4 Composite Pore#3 Dist. H20(5)	24.392	206.100	5.027	0.05	53.770	0.003	0.05%
R111-4 Composite Pore#4 Dist. H20(5)	24.392	206.100	5.027	0.05	53.770	0.003	0.05%
R111-4 Composite Pore#5 Dist. H20(5)	24.392	206.100	5.027	0.05	53.770	0.003	0.05%
R111-4 Composite Drainage Dist. H20(5)	24.392	206.100	5.027	0.05	53.770	0.003	0.05%
R111-4 Composite Composite Dist. H20(5)	24.392	206.100	5.027	0.05	53.770	0.003	0.05%
R111-4,3 Composite Pore#1 .05M CIT(5)	78.825	199.903	15.757	0.21	73.348	0.015	0.10%
R111-4,3 Composite Pore#2 .05M CIT(5)	78.825	199.903	15.757	10.51	73.348	0.771	4.89%
R111-4,3 Composite Pore#3 .05M CIT(5)	78.825	199.903	15.757	15.62	73.348	1.146	7.27%
R111-4,3 Composite Pore#4 .05M CIT(5)	78.825	199.903	15.757	12.47	73.348	0.915	5.80%
R111-4,3 Composite Pore#5 .05M CIT(5)	78.825	199.903	15.757	8.56	73.348	0.628	3.98%
R111-4,3 Composite Pore#6 .05M CIT(5)	78.825	199.903	15.757	6.73	73.348	0.494	3.13%
R111-4,3 Composite Pore#7 .05M CIT(5)	78.825	199.903	15.757	5.28	73.348	0.387	2.46%
R111-4,3 Composite Pore#8 .05M CIT(5)	78.825	199.903	15.757	5.73	73.348	0.420	2.67%
R111-4,3 Composite Drainage .05M CIT(5)	78.825	199.903	15.757	1.9	73.348	0.139	0.88%
R111-4,3 Composite Composite .05M CIT(5)	78.825	199.903	15.757	7.59	73.348	0.557	3.53%
R111-4,3 Composite Pore#1 Dist. H20(5)	78.825	199.903	15.757	0.05	73.348	0.004	0.02%
R111-4,3 Composite Pore#2 Dist. H20(5)	78.825	199.903	15.757	0.05	73.348	0.004	0.02%
R111-4,3 Composite Pore#3 Dist. H20(5)	78.825	199.903	15.757	0.05	73.348	0.004	0.02%
R111-4,3 Composite Pore#4 Dist. H20(5)	78.825	199.903	15.757	0.05	73.348	0.004	0.02%
R111-4,3 Composite Pore#5 Dist. H20(5)	78.825	199.903	15.757	0.05	73.348	0.004	0.02%
R111-4,3 Composite Drainage Dist. H20(5)	78.825	199.903	15.757	0.05	73.348	0.004	0.02%

Cd Removed by Columnar Flooding

SAMPLE	Cd (mg/kg)	Wt. of Soil (g)	Cd in Soil (mg)	Cd (mg/L)	Pore Volume (mL)	Cd in Sample (mg)	% Cd Removed
R111-4,3 Composite Composite Dist. H2O(5)	78.825	199.903	15.757	0.05	73.348	0.004	0.02%
R124 Composite Pore#1 .05M EDTA(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#2 .05M EDTA(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#3 .05M EDTA(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#4 .05M EDTA(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#5 .05M EDTA(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#6 .05M EDTA(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#7 .05M EDTA(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#8 .05M EDTA(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Drainage .05M EDTA(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Composite .05M EDTA(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#1 Dist. H2O(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#2 Dist. H2O(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#3 Dist. H2O(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#4 Dist. H2O(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Pore#5 Dist. H2O(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Composite Dist. H2O(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124 Composite Drainage Dist. H2O(5)	0.626	342.551	0.214	0.05	55.770	0.003	1.30%
R124-2 Composite Pore#1 .05M CIT(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#2 .05M CIT(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#3 .05M CIT(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#4 .05M CIT(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#5 .05M CIT(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#6 .05M CIT(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#7 .05M CIT(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#8 .05M CIT(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Composite .05M CIT(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Drainage .05M CIT(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#1 Dist. H2O(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#2 Dist. H2O(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#3 Dist. H2O(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#4 Dist. H2O(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Pore#5 Dist. H2O(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%

Cd Removed by Columnar Flooding

SAMPLE	Cd (mg/kg)	Wt. of Soil (g)	Cd in Soil (mg)	Cd (mg/L)	Pore Volume (mL)	Cd in Sample (mg)	% Cd Removed
R124-2 Composite Composite Dist. H2O(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-2 Composite Drainage Dist. H2O(5)	0.476	312.744	0.149	0.05	46.880	0.002	1.58%
R124-3 Composite Pore#1 .05M CIT(5)	2.298	213.391	0.490	0.05	63.700	0.003	0.65%
R124-3 Composite Pore#2 .05M CIT(5)	2.298	213.391	0.490	0.05	63.700	0.003	0.65%
R124-3 Composite Pore#3 .05M CIT(5)	2.298	213.391	0.490	0.05	63.700	0.003	0.65%
R124-3 Composite Pore#4 .05M CIT(5)	2.298	213.391	0.490	0.05	63.700	0.003	0.65%
R124-3 Composite Pore#5 .05M CIT(5)	2.298	213.391	0.490	0.05	63.700	0.003	0.65%
R124-3 Composite Pore#6 .05M CIT(5)	2.298	213.391	0.490	0.05	63.700	0.003	0.65%
R124-3 Composite Pore#7 .05M CIT(5)	2.298	213.391	0.490	0.05	63.700	0.003	0.65%
R124-3 Composite Pore#8 .05M CIT(5)	2.298	213.391	0.490	0.05	63.700	0.003	0.65%
R124-3 Composite Composite .05M CIT(5)	2.298	213.391	0.490	0.05	63.700	0.003	0.65%
R124-3 Composite Drainage .05M CIT(5)	2.298	213.391	0.490	0.05	63.700	0.003	0.65%
R124-3 Composite Pore#1 Dist. H2O(5)	2.298	213.391	0.490	0.05	63.750	0.003	0.65%
R124-3 Composite Pore#2 Dist. H2O(5)	2.298	213.391	0.490	0.05	63.750	0.003	0.65%
R124-3 Composite Pore#3 Dist. H2O(5)	2.298	213.391	0.490	0.05	63.750	0.003	0.65%
R124-3 Composite Pore#4 Dist. H2O(5)	2.298	213.391	0.490	0.05	63.750	0.003	0.65%
R124-3 Composite Pore#5 Dist. H2O(5)	2.298	213.391	0.490	0.05	63.750	0.003	0.65%
R124-3 Composite Composite Dist. H2O(5)	2.298	213.391	0.490	0.05	63.750	0.003	0.65%
R124-3 Composite Drainage Dist. H2O(5)	2.298	213.391	0.490	0.05	63.750	0.003	0.65%

Cr Removed by Columnar Flooding

SAMPLE	Cr (mg/kg)	Wt. of Soil (g)	Cr in Soil (mg)	Cr (mg/L)	Pore Volume (ml)	Cr in Sample (mg)	% Cr Removed
R111-2 Composite Pore#1 .05M CIT(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Pore#2 .05M CIT(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Pore#3 .05M CIT(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Pore#4 .05M CIT(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Pore#5 .05M CIT(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Pore#6 .05M CIT(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Pore#7 .05M CIT(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Pore#8 .05M CIT(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Composite .05M CIT(5)	46.741	188.124	8.793	0.17	38.280	0.007	0.07%
R111-2 Composite Drainage .05M CIT(5)	46.741	188.124	8.793	0.2	38.280	0.008	0.09%
R111-2 Composite Pore#1 Dist. H2O(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Pore#2 Dist. H2O(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Pore#3 Dist. H2O(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Pore#4 Dist. H2O(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Pore#5 Dist. H2O(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Drainage Dist. H2O(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-2 Composite Composite Dist. H2O(5)	46.741	188.124	8.793	0.15	38.280	0.006	0.07%
R111-3 Composite Pore#1 .05M CIT(5)	58.166	310.567	18.064	0.15	87.720	0.013	0.07%
R111-3 Composite Pore#2 .05M CIT(5)	58.166	310.567	18.064	0.15	87.720	0.013	0.07%
R111-3 Composite Pore#3 .05M CIT(5)	58.166	310.567	18.064	0.17	87.720	0.015	0.08%
R111-3 Composite Pore#4 .05M CIT(5)	58.166	310.567	18.064	0.22	87.720	0.019	0.11%
R111-3 Composite Pore#5 .05M CIT(5)	58.166	310.567	18.064	0.25	87.720	0.022	0.12%
R111-3 Composite Pore#6 .05M CIT(5)	58.166	310.567	18.064	0.23	87.720	0.020	0.11%
R111-3 Composite Pore#7 .05M CIT(5)	58.166	310.567	18.064	0.25	87.720	0.022	0.12%
R111-3 Composite Drainage .05M CIT(5)	58.166	310.567	18.064	0.31	87.720	0.027	0.15%
R111-3 Composite Composite .05M CIT(5)	58.166	310.567	18.064	0.2	87.720	0.018	0.10%
R111-3 Composite Pore#1 Dist. H2O(5)	58.166	310.567	18.064	0.15	87.840	0.013	0.07%
R111-3 Composite Pore#2 Dist. H2O(5)	58.166	310.567	18.064	0.15	87.840	0.013	0.07%
R111-3 Composite Pore#3 Dist. H2O(5)	58.166	310.567	18.064	0.15	87.840	0.013	0.07%
R111-3 Composite Pore#4 Dist. H2O(5)	58.166	310.567	18.064	0.15	87.840	0.013	0.07%
R111-3 Composite Pore#5 Dist. H2O(5)	58.166	310.567	18.064	0.15	87.840	0.013	0.07%
R111-3 Composite Drainage Dist. H2O(5)	58.166	310.567	18.064	0.15	87.840	0.013	0.07%
R111-3 Composite Composite Dist. H2O(5)	58.166	310.567	18.064	0.15	87.840	0.013	0.07%

Cr Removed by Columnar Flooding

SAMPLE	Cr (mg/kg)	Wt. of Soil (g)	Cr in Soil (mg)	Cr (mg/L)	Pore Volume (ml)	Cr in Sample (mg)	% Cr Removed
R111-4 Composite Pore#1 .05M CIT(5)	38.358	206.100	7.905	0.15	53.550	0.008	0.10%
R111-4 Composite Pore#2 .05M CIT(5)	38.358	206.100	7.905	0.15	53.550	0.008	0.10%
R111-4 Composite Pore#3 .05M CIT(5)	38.358	206.100	7.905	0.17	53.550	0.009	0.12%
R111-4 Composite Pore#4 .05M CIT(5)	38.358	206.100	7.905	0.23	53.550	0.012	0.16%
R111-4 Composite Pore#5 .05M CIT(5)	38.358	206.100	7.905	0.15	53.550	0.008	0.10%
R111-4 Composite Pore#6 .05M CIT(5)	38.358	206.100	7.905	0.15	53.550	0.008	0.10%
R111-4 Composite Pore#7 .05M CIT(5)	38.358	206.100	7.905	0.15	53.550	0.008	0.10%
R111-4 Composite Pore#8 .05M CIT(5)	38.358	206.100	7.905	0.15	53.550	0.008	0.10%
R111-4 Composite Drainage .05M CIT(5)	38.358	206.100	7.905	0.15	53.550	0.008	0.10%
R111-4 Composite Composite .05M CIT(5)	38.358	206.100	7.905	0.15	53.550	0.008	0.10%
R111-4 Composite Pore#1 Dist. H20(5)	38.358	206.100	7.905	0.15	53.770	0.008	0.10%
R111-4 Composite Pore#2 Dist. H20(5)	38.358	206.100	7.905	0.15	53.770	0.008	0.10%
R111-4 Composite Pore#3 Dist. H20(5)	38.358	206.100	7.905	0.15	53.770	0.008	0.10%
R111-4 Composite Pore#4 Dist. H20(5)	38.358	206.100	7.905	0.15	53.770	0.008	0.10%
R111-4 Composite Pore#5 Dist. H20(5)	38.358	206.100	7.905	0.15	53.770	0.008	0.10%
R111-4 Composite Drainage Dist. H20(5)	38.358	206.100	7.905	0.15	53.770	0.008	0.10%
R111-4 Composite Composite Dist. H20(5)	38.358	206.100	7.905	0.15	53.770	0.008	0.10%
R111-4,3 Composite Pore#1 .05M CIT(5)	38.985	199.903	7.793	0.15	73.348	0.011	0.14%
R111-4,3 Composite Pore#2 .05M CIT(5)	38.985	199.903	7.793	0.15	73.348	0.011	0.14%
R111-4,3 Composite Pore#3 .05M CIT(5)	38.985	199.903	7.793	0.23	73.348	0.017	0.22%
R111-4,3 Composite Pore#4 .05M CIT(5)	38.985	199.903	7.793	0.22	73.348	0.016	0.21%
R111-4,3 Composite Pore#5 .05M CIT(5)	38.985	199.903	7.793	0.22	73.348	0.016	0.21%
R111-4,3 Composite Pore#6 .05M CIT(5)	38.985	199.903	7.793	0.23	73.348	0.017	0.22%
R111-4,3 Composite Pore#7 .05M CIT(5)	38.985	199.903	7.793	0.28	73.348	0.021	0.26%
R111-4,3 Composite Pore#8 .05M CIT(5)	38.985	199.903	7.793	0.25	73.348	0.018	0.24%
R111-4,3 Composite Drainage .05M CIT(5)	38.985	199.903	7.793	0.28	73.348	0.021	0.26%
R111-4,3 Composite Composite .05M CIT(5)	38.985	199.903	7.793	0.2	73.348	0.015	0.19%
R111-4,3 Composite Pore#1 Dist. H20(5)	38.985	199.903	7.793	0.15	73.348	0.011	0.14%
R111-4,3 Composite Pore#2 Dist. H20(5)	38.985	199.903	7.793	0.15	73.348	0.011	0.14%
R111-4,3 Composite Pore#3 Dist. H20(5)	38.985	199.903	7.793	0.15	73.348	0.011	0.14%
R111-4,3 Composite Pore#4 Dist. H20(5)	38.985	199.903	7.793	0.15	73.348	0.011	0.14%
R111-4,3 Composite Pore#5 Dist. H20(5)	38.985	199.903	7.793	0.15	73.348	0.011	0.14%
R111-4,3 Composite Drainage Dist. H20(5)	38.985	199.903	7.793	0.15	73.348	0.011	0.14%

Cr Removed by Columnar Flooding

SAMPLE	Cr (mg/kg)	Wt. of Soil (g)	Cr in Soil (mg)	Cr (mg/L)	Pore Volume (ml)	Cr in Sample (mg)	% Cr Removed
R111-4,3 Composite Composite Dist. H2O(5)	38.985	199.903	7.793	0.15	73.348	0.011	0.14%
R124 Composite Pore#1 .05M EDTA(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#2 .05M EDTA(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#3 .05M EDTA(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#4 .05M EDTA(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#5 .05M EDTA(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#6 .05M EDTA(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#7 .05M EDTA(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#8 .05M EDTA(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Drainage .05M EDTA(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Composite .05M EDTA(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#1 Dist. H2O(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#2 Dist. H2O(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#3 Dist. H2O(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#4 Dist. H2O(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Pore#5 Dist. H2O(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Composite Dist. H2O(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124 Composite Drainage Dist. H2O(5)	8.633	342.551	2.957	0.15	55.770	0.008	0.28%
R124-2 Composite Pore#1 .05M CIT(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#2 .05M CIT(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#3 .05M CIT(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#4 .05M CIT(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#5 .05M CIT(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#6 .05M CIT(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#7 .05M CIT(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#8 .05M CIT(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Composite .05M CIT(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Drainage .05M CIT(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#1 Dist. H2O(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#2 Dist. H2O(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#3 Dist. H2O(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#4 Dist. H2O(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Pore#5 Dist. H2O(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%

Cr Removed by Columnar Flooding

SAMPLE	Cr (mg/kg)	Wt. of Soil (g)	Cr in Soil (mg)	Cr (mg/L)	Pore Volume (ml)	Cr in Sample (mg)	% Cr Removed
R124-2 Composite Composite Dist. H2O(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-2 Composite Drainage Dist. H2O(5)	7.977	312.744	2.495	0.15	46.880	0.007	0.28%
R124-3 Composite Pore#1 .05M CIT(5)	6.788	213.391	1.448	0.15	63.700	0.010	0.66%
R124-3 Composite Pore#2 .05M CIT(5)	6.788	213.391	1.448	0.15	63.700	0.010	0.66%
R124-3 Composite Pore#3 .05M CIT(5)	6.788	213.391	1.448	0.15	63.700	0.010	0.66%
R124-3 Composite Pore#4 .05M CIT(5)	6.788	213.391	1.448	0.15	63.700	0.010	0.66%
R124-3 Composite Pore#5 .05M CIT(5)	6.788	213.391	1.448	0.15	63.700	0.010	0.66%
R124-3 Composite Pore#6 .05M CIT(5)	6.788	213.391	1.448	0.15	63.700	0.010	0.66%
R124-3 Composite Pore#7 .05M CIT(5)	6.788	213.391	1.448	0.15	63.700	0.010	0.66%
R124-3 Composite Pore#8 .05M CIT(5)	6.788	213.391	1.448	0.15	63.700	0.010	0.66%
R124-3 Composite Composite .05M CIT(5)	6.788	213.391	1.448	0.15	63.700	0.010	0.66%
R124-3 Composite Drainage .05M CIT(5)	6.788	213.391	1.448	0.15	63.700	0.010	0.66%
R124-3 Composite Pore#1 Dist. H2O(5)	6.788	213.391	1.448	0.15	63.750	0.010	0.66%
R124-3 Composite Pore#2 Dist. H2O(5)	6.788	213.391	1.448	0.15	63.750	0.010	0.66%
R124-3 Composite Pore#3 Dist. H2O(5)	6.788	213.391	1.448	0.15	63.750	0.010	0.66%
R124-3 Composite Pore#4 Dist. H2O(5)	6.788	213.391	1.448	0.15	63.750	0.010	0.66%
R124-3 Composite Pore#5 Dist. H2O(5)	6.788	213.391	1.448	0.15	63.750	0.010	0.66%
R124-3 Composite Composite Dist. H2O(5)	6.788	213.391	1.448	0.15	63.750	0.010	0.66%
R124-3 Composite Drainage Dist. H2O(5)	6.788	213.391	1.448	0.15	63.750	0.010	0.66%

Cu Removed by Columnar Flooding

SAMPLE	Cu (mg/kg)	Wt. of Soil (g)	Cu in Soil (mg)	Cu (mg/L)	Pore Volume (ml)	Cu in Sample (mg)	% Cu Removed
R111-2 Composite Pore#1 .05M CIT(5)	392.773	188.124	73.890	4.3	38.280	0.165	0.22%
R111-2 Composite Pore#2 .05M CIT(5)	392.773	188.124	73.890	8.84	38.280	0.338	0.46%
R111-2 Composite Pore#3 .05M CIT(5)	392.773	188.124	73.890	8.73	38.280	0.334	0.45%
R111-2 Composite Pore#4 .05M CIT(5)	392.773	188.124	73.890	8.62	38.280	0.330	0.45%
R111-2 Composite Pore#5 .05M CIT(5)	392.773	188.124	73.890	8.59	38.280	0.329	0.45%
R111-2 Composite Pore#6 .05M CIT(5)	392.773	188.124	73.890	7.44	38.280	0.285	0.39%
R111-2 Composite Pore#7 .05M CIT(5)	392.773	188.124	73.890	6.59	38.280	0.252	0.34%
R111-2 Composite Pore#8 .05M CIT(5)	392.773	188.124	73.890	6	38.280	0.230	0.31%
R111-2 Composite Composite .05M CIT(5)	392.773	188.124	73.890	9.04	38.280	0.346	0.47%
R111-2 Composite Drainage .05M CIT(5)	392.773	188.124	73.890	10.92	38.280	0.418	0.57%
R111-2 Composite Pore#1 Dist. H2O(5)	392.773	188.124	73.890	0.79	38.280	0.030	0.04%
R111-2 Composite Pore#2 Dist. H2O(5)	392.773	188.124	73.890	0.72	38.280	0.028	0.04%
R111-2 Composite Pore#3 Dist. H2O(5)	392.773	188.124	73.890	0.87	38.280	0.033	0.05%
R111-2 Composite Pore#4 Dist. H2O(5)	392.773	188.124	73.890	0.72	38.280	0.028	0.04%
R111-2 Composite Pore#5 Dist. H2O(5)	392.773	188.124	73.890	0.39	38.280	0.015	0.02%
R111-2 Composite Drainage Dist. H2O(5)	392.773	188.124	73.890	0.38	38.280	0.015	0.02%
R111-2 Composite Composite Dist. H2O(5)	392.773	188.124	73.890	0.61	38.280	0.023	0.03%
R111-3 Composite Pore#1 .05M CIT(5)	335.786	310.567	104.284	1.36	87.720	0.119	0.11%
R111-3 Composite Pore#2 .05M CIT(5)	335.786	310.567	104.284	17.43	87.720	1.529	1.47%
R111-3 Composite Pore#3 .05M CIT(5)	335.786	310.567	104.284	17.45	87.720	1.531	1.47%
R111-3 Composite Pore#4 .05M CIT(5)	335.786	310.567	104.284	24.97	87.720	2.190	2.10%
R111-3 Composite Pore#5 .05M CIT(5)	335.786	310.567	104.284	24.86	87.720	2.181	2.09%
R111-3 Composite Pore#6 .05M CIT(5)	335.786	310.567	104.284	19.65	87.720	1.724	1.65%
R111-3 Composite Pore#7 .05M CIT(5)	335.786	310.567	104.284	17.45	87.720	1.531	1.47%
R111-3 Composite Drainage .05M CIT(5)	335.786	310.567	104.284	20.33	87.720	1.783	1.71%
R111-3 Composite Composite .05M CIT(5)	335.786	310.567	104.284	19.91	87.720	1.747	1.67%
R111-3 Composite Pore#1 Dist. H2O(5)	335.786	310.567	104.284	0.42	87.840	0.037	0.04%
R111-3 Composite Pore#2 Dist. H2O(5)	335.786	310.567	104.284	0.41	87.840	0.036	0.03%
R111-3 Composite Pore#3 Dist. H2O(5)	335.786	310.567	104.284	0.39	87.840	0.034	0.03%
R111-3 Composite Pore#4 Dist. H2O(5)	335.786	310.567	104.284	0.51	87.840	0.045	0.04%
R111-3 Composite Pore#5 Dist. H2O(5)	335.786	310.567	104.284	0.34	87.840	0.030	0.03%
R111-3 Composite Drainage Dist. H2O(5)	335.786	310.567	104.284	0.28	87.840	0.025	0.02%
R111-3 Composite Composite Dist. H2O(5)	335.786	310.567	104.284	0.38	87.840	0.033	0.03%

Cu Removed by Columnar Flooding

SAMPLE	Cu (mg/kg)	Wt. of Soil (g)	Cu in Soil (mg)	Cu (mg/L)	Pore Volume (ml)	Cu in Sample (mg)	% Cu Removed
R111-4 Composite Pore#1 .05M CIT(5)	258.584	206.100	53.294	7.86	53.550	0.421	0.79%
R111-4 Composite Pore#2 .05M CIT(5)	258.584	206.100	53.294	11.52	53.550	0.617	1.16%
R111-4 Composite Pore#3 .05M CIT(5)	258.584	206.100	53.294	11.46	53.550	0.614	1.15%
R111-4 Composite Pore#4 .05M CIT(5)	258.584	206.100	53.294	8.44	53.550	0.452	0.85%
R111-4 Composite Pore#5 .05M CIT(5)	258.584	206.100	53.294	6.9	53.550	0.369	0.69%
R111-4 Composite Pore#6 .05M CIT(5)	258.584	206.100	53.294	5.79	53.550	0.310	0.58%
R111-4 Composite Pore#7 .05M CIT(5)	258.584	206.100	53.294	5.27	53.550	0.282	0.53%
R111-4 Composite Pore#8 .05M CIT(5)	258.584	206.100	53.294	5.26	53.550	0.282	0.53%
R111-4 Composite Drainage .05M CIT(5)	258.584	206.100	53.294	13.73	53.550	0.735	1.38%
R111-4 Composite Composite .05M CIT(5)	258.584	206.100	53.294	8.81	53.550	0.472	0.89%
R111-4 Composite Pore#1 Dist. H2O(5)	258.584	206.100	53.294	0.64	53.770	0.034	0.06%
R111-4 Composite Pore#2 Dist. H2O(5)	258.584	206.100	53.294	0.75	53.770	0.040	0.08%
R111-4 Composite Pore#3 Dist. H2O(5)	258.584	206.100	53.294	0.48	53.770	0.026	0.05%
R111-4 Composite Pore#4 Dist. H2O(5)	258.584	206.100	53.294	0.38	53.770	0.020	0.04%
R111-4 Composite Pore#5 Dist. H2O(5)	258.584	206.100	53.294	0.31	53.770	0.017	0.03%
R111-4 Composite Drainage Dist. H2O(5)	258.584	206.100	53.294	0.31	53.770	0.017	0.03%
R111-4 Composite Composite Dist. H2O(5)	258.584	206.100	53.294	0.4	53.770	0.022	0.04%
R111-4,3 Composite Pore#1 .05M CIT(5)	419.777	199.903	83.915	7.1	73.348	0.521	0.62%
R111-4,3 Composite Pore#2 .05M CIT(5)	419.777	199.903	83.915	34.45	73.348	2.527	3.01%
R111-4,3 Composite Pore#3 .05M CIT(5)	419.777	199.903	83.915	28.45	73.348	2.087	2.49%
R111-4,3 Composite Pore#4 .05M CIT(5)	419.777	199.903	83.915	21	73.348	1.540	1.84%
R111-4,3 Composite Pore#5 .05M CIT(5)	419.777	199.903	83.915	16.75	73.348	1.229	1.46%
R111-4,3 Composite Pore#6 .05M CIT(5)	419.777	199.903	83.915	13.17	73.348	0.966	1.15%
R111-4,3 Composite Pore#7 .05M CIT(5)	419.777	199.903	83.915	13.88	73.348	1.018	1.21%
R111-4,3 Composite Pore#8 .05M CIT(5)	419.777	199.903	83.915	16.22	73.348	1.190	1.42%
R111-4,3 Composite Drainage .05M CIT(5)	419.777	199.903	83.915	12.51	73.348	0.918	1.09%
R111-4,3 Composite Composite .05M CIT(5)	419.777	199.903	83.915	19.05	73.348	1.397	1.67%
R111-4,3 Composite Pore#1 Dist. H2O(5)	419.777	199.903	83.915	0.33	73.348	0.024	0.03%
R111-4,3 Composite Pore#2 Dist. H2O(5)	419.777	199.903	83.915	0.5	73.348	0.037	0.04%
R111-4,3 Composite Pore#3 Dist. H2O(5)	419.777	199.903	83.915	0.48	73.348	0.035	0.04%
R111-4,3 Composite Pore#4 Dist. H2O(5)	419.777	199.903	83.915	0.4	73.348	0.029	0.03%
R111-4,3 Composite Pore#5 Dist. H2O(5)	419.777	199.903	83.915	0.39	73.348	0.029	0.03%
R111-4,3 Composite Drainage Dist. H2O(5)	419.777	199.903	83.915	0.38	73.348	0.028	0.03%

Cu Removed by Columnar Flooding

SAMPLE	Cu (mg/kg)	Wt. of Soil (g)	Cu in Soil (mg)	Cu (mg/L)	Pore Volume (ml)	Cu in Sample (mg)	% Cu Removed
R111-4,3 Composite Composite Dist. H2O(5)	419.777	199.903	83.915	0.5	73.348	0.037	0.04%
R124 Composite Pore#1 .05M EDTA(5)	3259.614	342.551	1116.583	34.52	55.770	1.925	0.17%
R124 Composite Pore#2 .05M EDTA(5)	3259.614	342.551	1116.583	36.05	55.770	2.011	0.18%
R124 Composite Pore#3 .05M EDTA(5)	3259.614	342.551	1116.583	33.52	55.770	1.869	0.17%
R124 Composite Pore#4 .05M EDTA(5)	3259.614	342.551	1116.583	31.14	55.770	1.737	0.16%
R124 Composite Pore#5 .05M EDTA(5)	3259.614	342.551	1116.583	25.44	55.770	1.419	0.13%
R124 Composite Pore#6 .05M EDTA(5)	3259.614	342.551	1116.583	26.28	55.770	1.466	0.13%
R124 Composite Pore#7 .05M EDTA(5)	3259.614	342.551	1116.583	22.34	55.770	1.246	0.11%
R124 Composite Pore#8 .05M EDTA(5)	3259.614	342.551	1116.583	22.29	55.770	1.243	0.11%
R124 Composite Drainage .05M EDTA(5)	3259.614	342.551	1116.583	22.59	55.770	1.260	0.11%
R124 Composite Composite .05M EDTA(5)	3259.614	342.551	1116.583	27.93	55.770	1.558	0.14%
R124 Composite Pore#1 Dist. H2O(5)	3259.614	342.551	1116.583	0.42	55.770	0.023	0.00%
R124 Composite Pore#2 Dist. H2O(5)	3259.614	342.551	1116.583	0.36	55.770	0.020	0.00%
R124 Composite Pore#3 Dist. H2O(5)	3259.614	342.551	1116.583	0.26	55.770	0.015	0.00%
R124 Composite Pore#4 Dist. H2O(5)	3259.614	342.551	1116.583	0.24	55.770	0.013	0.00%
R124 Composite Pore#5 Dist. H2O(5)	3259.614	342.551	1116.583	0.18	55.770	0.010	0.00%
R124 Composite Composite Dist. H2O(5)	3259.614	342.551	1116.583	0.28	55.770	0.016	0.00%
R124 Composite Drainage Dist. H2O(5)	3259.614	342.551	1116.583	0.28	55.770	0.016	0.00%
R124-2 Composite Pore#1 .05M CIT(5)	518.894	312.744	162.281	12.89	46.880	0.604	0.37%
R124-2 Composite Pore#2 .05M CIT(5)	518.894	312.744	162.281	19.59	46.880	0.918	0.57%
R124-2 Composite Pore#3 .05M CIT(5)	518.894	312.744	162.281	15.21	46.880	0.713	0.44%
R124-2 Composite Pore#4 .05M CIT(5)	518.894	312.744	162.281	15.33	46.880	0.719	0.44%
R124-2 Composite Pore#5 .05M CIT(5)	518.894	312.744	162.281	16.8	46.880	0.788	0.49%
R124-2 Composite Pore#6 .05M CIT(5)	518.894	312.744	162.281	21.06	46.880	0.987	0.61%
R124-2 Composite Pore#7 .05M CIT(5)	518.894	312.744	162.281	21.31	46.880	0.999	0.62%
R124-2 Composite Pore#8 .05M CIT(5)	518.894	312.744	162.281	19.42	46.880	0.910	0.56%
R124-2 Composite Composite .05M CIT(5)	518.894	312.744	162.281	16.14	46.880	0.757	0.47%
R124-2 Composite Drainage .05M CIT(5)	518.894	312.744	162.281	16.97	46.880	0.796	0.49%
R124-2 Composite Pore#1 Dist. H2O(5)	518.894	312.744	162.281	1.29	46.880	0.060	0.04%
R124-2 Composite Pore#2 Dist. H2O(5)	518.894	312.744	162.281	1.01	46.880	0.047	0.03%
R124-2 Composite Pore#3 Dist. H2O(5)	518.894	312.744	162.281	0.5	46.880	0.023	0.01%
R124-2 Composite Pore#4 Dist. H2O(5)	518.894	312.744	162.281	0.39	46.880	0.018	0.01%
R124-2 Composite Pore#5 Dist. H2O(5)	518.894	312.744	162.281	0.4	46.880	0.019	0.01%

Cu Removed by Columnar Flooding

SAMPLE	Cu (mg/kg)	Wt. of Soil (g)	Cu in Soil (mg)	Cu (mg/L)	Pore Volume (ml)	Cu in Sample (mg)	% Cu Removed
R124-2 Composite Composite Dist. H2O(5)	518.894	312.744	162.281	0.56	46.880	0.026	0.02%
R124-2 Composite Drainage Dist. H2O(5)	518.894	312.744	162.281	0.39	46.880	0.018	0.01%
R124-3 Composite Pore#1 .05M CIT(5)	647.430	213.391	138.155	1.65	63.700	0.105	0.08%
R124-3 Composite Pore#2 .05M CIT(5)	647.430	213.391	138.155	15.13	63.700	0.964	0.70%
R124-3 Composite Pore#3 .05M CIT(5)	647.430	213.391	138.155	24.68	63.700	1.572	1.14%
R124-3 Composite Pore#4 .05M CIT(5)	647.430	213.391	138.155	18.89	63.700	1.203	0.87%
R124-3 Composite Pore#5 .05M CIT(5)	647.430	213.391	138.155	15.85	63.700	1.010	0.73%
R124-3 Composite Pore#6 .05M CIT(5)	647.430	213.391	138.155	15.62	63.700	0.995	0.72%
R124-3 Composite Pore#7 .05M CIT(5)	647.430	213.391	138.155	15.12	63.700	0.963	0.70%
R124-3 Composite Pore#8 .05M CIT(5)	647.430	213.391	138.155	13.47	63.700	0.858	0.62%
R124-3 Composite Composite .05M CIT(5)	647.430	213.391	138.155	16.45	63.700	1.048	0.76%
R124-3 Composite Drainage .05M CIT(5)	647.430	213.391	138.155	12.15	63.700	0.774	0.56%
R124-3 Composite Pore#1 Dist. H2O(5)	647.430	213.391	138.155	1.19	63.750	0.076	0.05%
R124-3 Composite Pore#2 Dist. H2O(5)	647.430	213.391	138.155	0.91	63.750	0.058	0.04%
R124-3 Composite Pore#3 Dist. H2O(5)	647.430	213.391	138.155	0.88	63.750	0.056	0.04%
R124-3 Composite Pore#4 Dist. H2O(5)	647.430	213.391	138.155	0.79	63.750	0.050	0.04%
R124-3 Composite Pore#5 Dist. H2O(5)	647.430	213.391	138.155	0.76	63.750	0.048	0.04%
R124-3 Composite Composite Dist. H2O(5)	647.430	213.391	138.155	0.84	63.750	0.054	0.04%
R124-3 Composite Drainage Dist. H2O(5)	647.430	213.391	138.155	0.74	63.750	0.047	0.03%

Fe Removed by Columnar Flooding

SAMPLE	Fe (mg/kg)	Wt. of Soil (g)	Fe in Soil (mg)	Fe (mg/L)	Pore Volume (ml)	Fe in Sample (mg)	% Fe Removed
R111-2 Composite Pore#1 .05M CIT(5)	16852.850	188.124	3170.431	5.95	38.280	0.228	0.01%
R111-2 Composite Pore#2 .05M CIT(5)	16852.850	188.124	3170.431	10.28	38.280	0.394	0.01%
R111-2 Composite Pore#3 .05M CIT(5)	16852.850	188.124	3170.431	12.87	38.280	0.493	0.02%
R111-2 Composite Pore#4 .05M CIT(5)	16852.850	188.124	3170.431	15.94	38.280	0.610	0.02%
R111-2 Composite Pore#5 .05M CIT(5)	16852.850	188.124	3170.431	16.28	38.280	0.623	0.02%
R111-2 Composite Pore#6 .05M CIT(5)	16852.850	188.124	3170.431	18.38	38.280	0.704	0.02%
R111-2 Composite Pore#7 .05M CIT(5)	16852.850	188.124	3170.431	18.57	38.280	0.711	0.02%
R111-2 Composite Pore#8 .05M CIT(5)	16852.850	188.124	3170.431	19.39	38.280	0.742	0.02%
R111-2 Composite Composite .05M CIT(5)	16852.850	188.124	3170.431	17.69	38.280	0.677	0.02%
R111-2 Composite Drainage .05M CIT(5)	16852.850	188.124	3170.431	41.11	38.280	1.574	0.05%
R111-2 Composite Pore#1 Dist. H2O(5)	16852.850	188.124	3170.431	6.97	38.280	0.267	0.01%
R111-2 Composite Pore#2 Dist. H2O(5)	16852.850	188.124	3170.431	7.64	38.280	0.292	0.01%
R111-2 Composite Pore#3 Dist. H2O(5)	16852.850	188.124	3170.431	11.14	38.280	0.426	0.01%
R111-2 Composite Pore#4 Dist. H2O(5)	16852.850	188.124	3170.431	14.62	38.280	0.560	0.02%
R111-2 Composite Pore#5 Dist. H2O(5)	16852.850	188.124	3170.431	13.57	38.280	0.519	0.02%
R111-2 Composite Drainage Dist. H2O(5)	16852.850	188.124	3170.431	9.45	38.280	0.362	0.01%
R111-2 Composite Composite Dist. H2O(5)	16852.850	188.124	3170.431	10.97	38.280	0.420	0.01%
R111-3 Composite Pore#1 .05M CIT(5)	20954.455	310.567	6507.754	1.87	87.720	0.164	0.00%
R111-3 Composite Pore#2 .05M CIT(5)	20954.455	310.567	6507.754	7.64	87.720	0.670	0.01%
R111-3 Composite Pore#3 .05M CIT(5)	20954.455	310.567	6507.754	18.52	87.720	1.625	0.02%
R111-3 Composite Pore#4 .05M CIT(5)	20954.455	310.567	6507.754	18.9	87.720	1.658	0.03%
R111-3 Composite Pore#5 .05M CIT(5)	20954.455	310.567	6507.754	31.48	87.720	2.761	0.04%
R111-3 Composite Pore#6 .05M CIT(5)	20954.455	310.567	6507.754	31.52	87.720	2.765	0.04%
R111-3 Composite Pore#7 .05M CIT(5)	20954.455	310.567	6507.754	41.19	87.720	3.613	0.06%
R111-3 Composite Drainage .05M CIT(5)	20954.455	310.567	6507.754	46.23	87.720	4.055	0.06%
R111-3 Composite Composite .05M CIT(5)	20954.455	310.567	6507.754	30.19	87.720	2.648	0.04%
R111-3 Composite Pore#1 Dist. H2O(5)	20954.455	310.567	6507.754	1.13	87.840	0.099	0.00%
R111-3 Composite Pore#2 Dist. H2O(5)	20954.455	310.567	6507.754	1.17	87.840	0.103	0.00%
R111-3 Composite Pore#3 Dist. H2O(5)	20954.455	310.567	6507.754	1.5	87.840	0.132	0.00%
R111-3 Composite Pore#4 Dist. H2O(5)	20954.455	310.567	6507.754	3.22	87.840	0.283	0.00%
R111-3 Composite Pore#5 Dist. H2O(5)	20954.455	310.567	6507.754	0.78	87.840	0.069	0.00%
R111-3 Composite Drainage Dist. H2O(5)	20954.455	310.567	6507.754	0.58	87.840	0.051	0.00%
R111-3 Composite Composite Dist. H2O(5)	20954.455	310.567	6507.754	1.32	87.840	0.116	0.00%

Fe Removed by Columnar Flooding

SAMPLE	Fe (mg/kg)	Wt. of Soil (g)	Fe in Soil (mg)	Fe (mg/L)	Pore Volume (ml)	Fe in Sample (mg)	% Fe Removed
R111-4 Composite Pore#1 .05M CIT(5)	17551.639	206.100	3617.393	5.69	53.550	0.305	0.01%
R111-4 Composite Pore#2 .05M CIT(5)	17551.639	206.100	3617.393	11.23	53.550	0.601	0.02%
R111-4 Composite Pore#3 .05M CIT(5)	17551.639	206.100	3617.393	15.43	53.550	0.826	0.02%
R111-4 Composite Pore#4 .05M CIT(5)	17551.639	206.100	3617.393	16.64	53.550	0.891	0.02%
R111-4 Composite Pore#5 .05M CIT(5)	17551.639	206.100	3617.393	17.51	53.550	0.938	0.03%
R111-4 Composite Pore#6 .05M CIT(5)	17551.639	206.100	3617.393	17.39	53.550	0.931	0.03%
R111-4 Composite Pore#7 .05M CIT(5)	17551.639	206.100	3617.393	17.45	53.550	0.934	0.03%
R111-4 Composite Pore#8 .05M CIT(5)	17551.639	206.100	3617.393	18.14	53.550	0.971	0.03%
R111-4 Composite Drainage .05M CIT(5)	17551.639	206.100	3617.393	16.76	53.550	0.897	0.02%
R111-4 Composite Composite .05M CIT(5)	17551.639	206.100	3617.393	16.31	53.550	0.873	0.02%
R111-4 Composite Pore#1 Dist. H2O(5)	17551.639	206.100	3617.393	2.13	53.770	0.115	0.00%
R111-4 Composite Pore#2 Dist. H2O(5)	17551.639	206.100	3617.393	1.91	53.770	0.103	0.00%
R111-4 Composite Pore#3 Dist. H2O(5)	17551.639	206.100	3617.393	1.21	53.770	0.065	0.00%
R111-4 Composite Pore#4 Dist. H2O(5)	17551.639	206.100	3617.393	0.87	53.770	0.047	0.00%
R111-4 Composite Pore#5 Dist. H2O(5)	17551.639	206.100	3617.393	0.58	53.770	0.031	0.00%
R111-4 Composite Drainage Dist. H2O(5)	17551.639	206.100	3617.393	0.5	53.770	0.027	0.00%
R111-4 Composite Composite Dist. H2O(5)	17551.639	206.100	3617.393	0.76	53.770	0.041	0.00%
R111-4,3 Composite Pore#1 .05M CIT(5)	13675.318	199.903	2733.739	6.34	73.348	0.465	0.02%
R111-4,3 Composite Pore#2 .05M CIT(5)	13675.318	199.903	2733.739	15.16	73.348	1.112	0.04%
R111-4,3 Composite Pore#3 .05M CIT(5)	13675.318	199.903	2733.739	18.83	73.348	1.381	0.05%
R111-4,3 Composite Pore#4 .05M CIT(5)	13675.318	199.903	2733.739	18.16	73.348	1.332	0.05%
R111-4,3 Composite Pore#5 .05M CIT(5)	13675.318	199.903	2733.739	19.67	73.348	1.443	0.05%
R111-4,3 Composite Pore#6 .05M CIT(5)	13675.318	199.903	2733.739	30.14	73.348	2.211	0.08%
R111-4,3 Composite Pore#7 .05M CIT(5)	13675.318	199.903	2733.739	35.67	73.348	2.616	0.10%
R111-4,3 Composite Pore#8 .05M CIT(5)	13675.318	199.903	2733.739	43.13	73.348	3.163	0.12%
R111-4,3 Composite Drainage .05M CIT(5)	13675.318	199.903	2733.739	46.48	73.348	3.409	0.12%
R111-4,3 Composite Composite .05M CIT(5)	13675.318	199.903	2733.739	18.5	73.348	1.357	0.05%
R111-4,3 Composite Pore#1 Dist. H2O(5)	13675.318	199.903	2733.739	3.64	73.348	0.267	0.01%
R111-4,3 Composite Pore#2 Dist. H2O(5)	13675.318	199.903	2733.739	1.8	73.348	0.132	0.00%
R111-4,3 Composite Pore#3 Dist. H2O(5)	13675.318	199.903	2733.739	1.25	73.348	0.092	0.00%
R111-4,3 Composite Pore#4 Dist. H2O(5)	13675.318	199.903	2733.739	0.77	73.348	0.056	0.00%
R111-4,3 Composite Pore#5 Dist. H2O(5)	13675.318	199.903	2733.739	0.54	73.348	0.040	0.00%
R111-4,3 Composite Drainage Dist. H2O(5)	13675.318	199.903	2733.739	1.12	73.348	0.082	0.00%

Fe Removed by Columnar Flooding

SAMPLE	Fe (mg/kg)	Wt. of Soil (g)	Fe in Soil (mg)	Fe (mg/L)	Pore Volume (ml)	Fe in Sample (mg)	% Fe Removed
R111-4,3 Composite Composite Dist. H2O(5)	13675.318	199.903	2733.739	1.35	73.348	0.099	0.00%
R124 Composite Pore#1 .05M EDTA(5)	5052.111	342.551	1730.604	16.85	55.770	0.940	0.05%
R124 Composite Pore#2 .05M EDTA(5)	5052.111	342.551	1730.604	17.72	55.770	0.988	0.06%
R124 Composite Pore#3 .05M EDTA(5)	5052.111	342.551	1730.604	16.41	55.770	0.915	0.05%
R124 Composite Pore#4 .05M EDTA(5)	5052.111	342.551	1730.604	14.98	55.770	0.835	0.05%
R124 Composite Pore#5 .05M EDTA(5)	5052.111	342.551	1730.604	15.47	55.770	0.863	0.05%
R124 Composite Pore#6 .05M EDTA(5)	5052.111	342.551	1730.604	15.51	55.770	0.865	0.05%
R124 Composite Pore#7 .05M EDTA(5)	5052.111	342.551	1730.604	14.8	55.770	0.825	0.05%
R124 Composite Pore#8 .05M EDTA(5)	5052.111	342.551	1730.604	14.35	55.770	0.800	0.05%
R124 Composite Drainage .05M EDTA(5)	5052.111	342.551	1730.604	14.48	55.770	0.808	0.05%
R124 Composite Composite .05M EDTA(5)	5052.111	342.551	1730.604	14.95	55.770	0.834	0.05%
R124 Composite Pore#1 Dist. H2O(5)	5052.111	342.551	1730.604	1.31	55.770	0.073	0.00%
R124 Composite Pore#2 Dist. H2O(5)	5052.111	342.551	1730.604	1.56	55.770	0.087	0.01%
R124 Composite Pore#3 Dist. H2O(5)	5052.111	342.551	1730.604	1.64	55.770	0.091	0.01%
R124 Composite Pore#4 Dist. H2O(5)	5052.111	342.551	1730.604	1.31	55.770	0.073	0.00%
R124 Composite Pore#5 Dist. H2O(5)	5052.111	342.551	1730.604	1.11	55.770	0.062	0.00%
R124 Composite Composite Dist. H2O(5)	5052.111	342.551	1730.604	1.12	55.770	0.062	0.00%
R124 Composite Drainage Dist. H2O(5)	5052.111	342.551	1730.604	1.36	55.770	0.076	0.00%
R124-2 Composite Pore#1 .05M CIT(5)	4225.295	312.744	1321.437	11.52	46.880	0.540	0.04%
R124-2 Composite Pore#2 .05M CIT(5)	4225.295	312.744	1321.437	13	46.880	0.609	0.05%
R124-2 Composite Pore#3 .05M CIT(5)	4225.295	312.744	1321.437	13.93	46.880	0.653	0.05%
R124-2 Composite Pore#4 .05M CIT(5)	4225.295	312.744	1321.437	14.78	46.880	0.693	0.05%
R124-2 Composite Pore#5 .05M CIT(5)	4225.295	312.744	1321.437	13.76	46.880	0.645	0.05%
R124-2 Composite Pore#6 .05M CIT(5)	4225.295	312.744	1321.437	13.98	46.880	0.655	0.05%
R124-2 Composite Pore#7 .05M CIT(5)	4225.295	312.744	1321.437	15.28	46.880	0.716	0.05%
R124-2 Composite Pore#8 .05M CIT(5)	4225.295	312.744	1321.437	17.32	46.880	0.812	0.06%
R124-2 Composite Composite .05M CIT(5)	4225.295	312.744	1321.437	14.62	46.880	0.685	0.05%
R124-2 Composite Drainage .05M CIT(5)	4225.295	312.744	1321.437	17.46	46.880	0.819	0.06%
R124-2 Composite Pore#1 Dist. H2O(5)	4225.295	312.744	1321.437	7.83	46.880	0.367	0.03%
R124-2 Composite Pore#2 Dist. H2O(5)	4225.295	312.744	1321.437	5.88	46.880	0.276	0.02%
R124-2 Composite Pore#3 Dist. H2O(5)	4225.295	312.744	1321.437	3.14	46.880	0.147	0.01%
R124-2 Composite Pore#4 Dist. H2O(5)	4225.295	312.744	1321.437	2.87	46.880	0.135	0.01%
R124-2 Composite Pore#5 Dist. H2O(5)	4225.295	312.744	1321.437	4.28	46.880	0.201	0.02%

Fe Removed by Columnar Flooding

SAMPLE	Fe (mg/kg)	Wt. of Soil (g)	Fe in Soil (mg)	Fe (mg/L)	Pore Volume (ml)	Fe in Sample (mg)	% Fe Removed
R124-2 Composite Composite Dist. H2O(5)	4225.295	312.744	1321.437	4.2	46.880	0.197	0.01%
R124-2 Composite Drainage Dist. H2O(5)	4225.295	312.744	1321.437	3.51	46.880	0.165	0.01%
R124-3 Composite Pore#1 .05M CIT(5)	3886.913	213.391	829.431	0.75	63.700	0.048	0.01%
R124-3 Composite Pore#2 .05M CIT(5)	3886.913	213.391	829.431	3.68	63.700	0.234	0.03%
R124-3 Composite Pore#3 .05M CIT(5)	3886.913	213.391	829.431	6.79	63.700	0.433	0.05%
R124-3 Composite Pore#4 .05M CIT(5)	3886.913	213.391	829.431	6.67	63.700	0.425	0.05%
R124-3 Composite Pore#5 .05M CIT(5)	3886.913	213.391	829.431	6.43	63.700	0.410	0.05%
R124-3 Composite Pore#6 .05M CIT(5)	3886.913	213.391	829.431	6.35	63.700	0.404	0.05%
R124-3 Composite Pore#7 .05M CIT(5)	3886.913	213.391	829.431	6.21	63.700	0.396	0.05%
R124-3 Composite Pore#8 .05M CIT(5)	3886.913	213.391	829.431	6.11	63.700	0.389	0.05%
R124-3 Composite Composite .05M CIT(5)	3886.913	213.391	829.431	5.81	63.700	0.370	0.04%
R124-3 Composite Drainage .05M CIT(5)	3886.913	213.391	829.431	6.87	63.700	0.438	0.05%
R124-3 Composite Pore#1 Dist. H2O(5)	3886.913	213.391	829.431	0.66	63.750	0.042	0.01%
R124-3 Composite Pore#2 Dist. H2O(5)	3886.913	213.391	829.431	0.5	63.750	0.032	0.00%
R124-3 Composite Pore#3 Dist. H2O(5)	3886.913	213.391	829.431	0.63	63.750	0.040	0.00%
R124-3 Composite Pore#4 Dist. H2O(5)	3886.913	213.391	829.431	0.5	63.750	0.032	0.00%
R124-3 Composite Pore#5 Dist. H2O(5)	3886.913	213.391	829.431	0.5	63.750	0.032	0.00%
R124-3 Composite Composite Dist. H2O(5)	3886.913	213.391	829.431	0.5	63.750	0.032	0.00%
R124-3 Composite Drainage Dist. H2O(5)	3886.913	213.391	829.431	0.52	63.750	0.033	0.00%

Pb Removed by Columnar Flooding

SAMPLE	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pore Volume (ml)	Pb in Sample (mg)	% Pb Removed
Dist. H2O Pore #1 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	0.91	113.400	0.103	0.00%
Dist. H2O Pore #2 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	4.83	113.400	0.548	0.02%
Dist. H2O Pore #3 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	1.22	113.400	0.138	0.01%
Dist. H2O Pore #4 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	3.66	113.400	0.415	0.02%
Dist. H2O Pore #5 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	5.52	113.400	0.626	0.02%
Dist. H2O Drainage Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	0.91	113.400	0.103	0.00%
Dist. H2O Composite Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	3.05	113.400	0.346	0.01%
.01 EDTA Pore #1 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	19.91	113.400	2.258	0.09%
.01 EDTA Pore #2 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	166.94	113.400	18.931	0.75%
.01 EDTA Pore #3 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	144.47	113.400	16.383	0.65%
.01 EDTA Pore #4 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	106.50	113.400	12.077	0.48%
.01 EDTA Pore #5 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	83.33	113.400	9.450	0.38%
.01 EDTA Pore #6 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	59.73	113.400	6.773	0.27%
.01 EDTA Pore #7 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	63.93	113.400	7.250	0.29%
.01 EDTA Pore #8 Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	59.86	113.400	6.788	0.27%
.01 EDTA Drainage Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	17.87	113.400	2.026	0.08%
.01 EDTA Composite Aberdeen 5000ppm Pb(NO3)2	5000	503.699	2518.496	116.30	113.400	13.188	0.52%
Dist. H2O Pore #1 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	0.50	106.640	0.053	0.00%
Dist. H2O Pore #2 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	0.50	106.640	0.053	0.00%
Dist. H2O Pore #3 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	0.50	106.640	0.053	0.00%
Dist. H2O Pore #4 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	0.50	106.640	0.053	0.00%
Dist. H2O Pore #5 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	0.50	106.640	0.053	0.00%
Dist. H2O Drainage FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	2.13	106.640	0.227	0.01%
Dist. H2O Composite FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	0.91	106.640	0.097	0.00%
.01 EDTA Pore #1 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	121.22	106.640	12.927	0.57%
.01 EDTA Pore #2 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	538.57	106.640	57.433	2.53%
.01 EDTA Pore #3 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	829.15	106.640	88.421	3.90%
.01 EDTA Pore #4 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	72.74	106.640	7.757	0.34%
.01 EDTA Pore #5 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	431.40	106.640	46.004	2.03%
.01 EDTA Pore #6 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	325.92	106.640	34.756	1.53%
.01 EDTA Pore #7 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	27.53	106.640	2.936	0.13%
.01 EDTA Pore #8 FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	222.48	106.640	23.725	1.05%
.01 EDTA Drainage FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	188.72	106.640	20.125	0.89%

Pb Removed by Columnar Flooding

SAMPLE	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pore Volume (ml)	Pb in Sample (mg)	% Pb Removed
.01 EDTA Composite FT. MEAD 5000ppm Pb(NO3)2	5000	453.897	2269.485	36.67	106.640	3.910	0.17%
Dist. H2O Pore #1 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	1.52	115.830	0.176	0.01%
Dist. H2O Pore #2 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	0.60	115.830	0.069	0.00%
Dist. H2O Pore #3 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	0.50	115.830	0.058	0.00%
Dist. H2O Pore #4 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	0.50	115.830	0.058	0.00%
Dist. H2O Pore #5 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	0.61	115.830	0.071	0.00%
Dist. H2O Drainage LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	0.50	115.830	0.058	0.00%
Dist. H2O Composite LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	0.91	115.830	0.105	0.01%
.05 EDTA Pore #1 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	289.51	115.830	33.534	1.74%
.05 EDTA Pore #2 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	307.00	115.830	35.560	1.85%
.05 EDTA Pore #3 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	320.58	115.830	37.133	1.93%
.05 EDTA Pore #4 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	424.36	115.830	49.154	2.56%
.05 EDTA Pore #5 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	477.64	115.830	55.325	2.88%
.05 EDTA Pore #6 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	417.35	115.830	48.342	2.51%
.05 EDTA Pore #7 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	396.34	115.830	45.908	2.39%
.05 EDTA Pore #8 LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	313.07	115.830	36.263	1.89%
.05 EDTA Drainage LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	272.57	115.830	31.572	1.64%
.05 EDTA Composite LAAFB 5000ppm Pb(NO3)2	5000	384.660	1923.300	392.37	115.830	45.448	2.36%
LAAFB-2 Pore #1 .05M EDTA 10K ppm	10000	198.496	1984.964	232.62	48.800	11.352	0.57%
LAAFB-2 Pore #2 .05M EDTA 10K ppm	10000	198.496	1984.964	351.99	48.800	17.177	0.87%
LAAFB-2 Pore #3 .05M EDTA 10K ppm	10000	198.496	1984.964	414.99	48.800	20.252	1.02%
LAAFB-2 Pore #4 .05M EDTA 10K ppm	10000	198.496	1984.964	379.18	48.800	18.504	0.93%
LAAFB-2 Pore #5 .05M EDTA 10K ppm	10000	198.496	1984.964	374.35	48.800	18.268	0.92%
LAAFB-2 Pore #6 .05M EDTA 10K ppm	10000	198.496	1984.964	504.13	48.800	24.602	1.24%
LAAFB-2 Pore #7 .05M EDTA 10K ppm	10000	198.496	1984.964	507.57	48.800	24.769	1.25%
LAAFB-2 Pore #8 .05M EDTA 10K ppm	10000	198.496	1984.964	421.57	48.800	20.573	1.04%
LAAFB-2 Composite .05M EDTA 10K ppm	10000	198.496	1984.964	523.22	48.800	25.533	1.29%
LAAFB-2 Drainage .05M EDTA 10K ppm	10000	198.496	1984.964	315.88	48.800	15.415	0.78%
LAAFB-2 Pore #1 DIST. H2O(5) 10K ppm	10000	198.496	1984.964	1.14	48.930	0.056	0.00%
LAAFB-2 Pore #2 DIST. H2O(5) 10K ppm	10000	198.496	1984.964	0.94	48.930	0.046	0.00%
LAAFB-2 Pore #3 DIST. H2O(5) 10K ppm	10000	198.496	1984.964	1.03	48.930	0.050	0.00%
LAAFB-2 Pore #4 DIST. H2O(5) 10K ppm	10000	198.496	1984.964	0.59	48.930	0.029	0.00%
LAAFB-2 Pore #5 DIST. H2O(5) 10K ppm	10000	198.496	1984.964	0.60	48.930	0.029	0.00%

Pb Removed by Columnar Flooding

SAMPLE	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pore Volume (ml)	Pb in Sample (mg)	% Pb Removed
LAAFB-2 Composite DIST. H2O(5) 10K ppm	10000	198.496	1984.964	0.67	48.930	0.033	0.00%
LAAFB-2 Drainage DIST. H2O(5) 10K ppm	10000	198.496	1984.964	0.58	48.930	0.028	0.00%
LAAFB-3 Pore #1 .05M CIT(5) 10K ppm	10000	198.537	1985.371	137.12	52.270	7.167	0.36%
LAAFB-3 Pore #2 .05M CIT(5) 10K ppm	10000	198.537	1985.371	225.26	52.270	11.774	0.59%
LAAFB-3 Pore #3 .05M CIT(5) 10K ppm	10000	198.537	1985.371	268.41	52.270	14.030	0.71%
LAAFB-3 Pore #4 .05M CIT(5) 10K ppm	10000	198.537	1985.371	366.33	52.270	19.148	0.96%
LAAFB-3 Pore #5 .05M CIT(5) 10K ppm	10000	198.537	1985.371	308.12	52.270	16.105	0.81%
LAAFB-3 Pore #6 .05M CIT(5) 10K ppm	10000	198.537	1985.371	269.92	52.270	14.109	0.71%
LAAFB-3 Pore #7 .05M CIT(5) 10K ppm	10000	198.537	1985.371	212.12	52.270	11.088	0.56%
LAAFB-3 Pore #8 .05M CIT(5) 10K ppm	10000	198.537	1985.371	206.32	52.270	10.784	0.54%
LAAFB-3 Composite .05M CIT(5) 10K ppm	10000	198.537	1985.371	188.93	52.270	9.875	0.50%
LAAFB-3 Drainage .05M CIT(5) 10K ppm	10000	198.537	1985.371	145.40	52.270	7.600	0.38%
LAAFB-3 Pore #1 DIST. H2O(5) 10K ppm	10000	198.537	1985.371	3.67	52.270	0.192	0.01%
LAAFB-3 Pore #2 DIST. H2O(5) 10K ppm	10000	198.537	1985.371	2.74	52.270	0.143	0.01%
LAAFB-3 Pore #3 DIST. H2O(5) 10K ppm	10000	198.537	1985.371	2.49	52.270	0.130	0.01%
LAAFB-3 Pore #4 DIST. H2O(5) 10K ppm	10000	198.537	1985.371	1.67	52.270	0.087	0.00%
LAAFB-3 Pore #5 DIST. H2O(5) 10K ppm	10000	198.537	1985.371	1.39	52.270	0.073	0.00%
LAAFB-3 Composite DIST. H2O(5) 10K ppm	10000	198.537	1985.371	1.92	52.270	0.100	0.01%
LAAFB-3 Drainage DIST. H2O(5) 10K ppm	10000	198.537	1985.371	2.02	52.270	0.106	0.01%
R111 Composite Pore #1 Dist. H2O	124.169	180.861	22.457	1.10	42.080	0.046	0.21%
R111 Composite Pore #2 Dist. H2O	124.169	180.861	22.457	1.42	42.080	0.060	0.27%
R111 Composite Pore #3 Dist. H2O	124.169	180.861	22.457	0.50	42.080	0.021	0.09%
R111 Composite Pore #4 Dist. H2O	124.169	180.861	22.457	0.50	42.080	0.021	0.09%
R111 Composite Pore #5 Dist. H2O	124.169	180.861	22.457	0.50	42.080	0.021	0.09%
R111 Composite Drainage Dist. H2O	124.169	180.861	22.457	1.41	42.080	0.059	0.26%
R111 Composite Composite Dist. H2O	124.169	180.861	22.457	0.78	42.080	0.033	0.15%
R111 Composite Pore #1 .05M EDTA	124.169	180.861	22.457	0.63	42.080	0.027	0.12%
R111 Composite Pore #2 .05M EDTA	124.169	180.861	22.457	3.28	42.080	0.138	0.61%
R111 Composite Pore #3 .05M EDTA	124.169	180.861	22.457	9.94	42.080	0.418	1.86%
R111 Composite Pore #4 .05M EDTA	124.169	180.861	22.457	12.79	42.080	0.538	2.40%
R111 Composite Pore #5 .05M EDTA	124.169	180.861	22.457	9.94	42.080	0.418	1.86%
R111 Composite Pore #6 .05M EDTA	124.169	180.861	22.457	7.11	42.080	0.299	1.33%
R111 Composite Pore #7 .05M EDTA	124.169	180.861	22.457	5.55	42.080	0.234	1.04%

Pb Removed by Columnar Flooding

SAMPLE	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pore Volume (ml)	Pb in Sample (mg)	% Pb Removed
R111 Composite Pore #8 .05M EDTA	124.169	180.861	22.457	4.93	42.080	0.207	0.92%
R111 Composite Drainage .05M EDTA	124.169	180.861	22.457	6.08	42.080	0.256	1.14%
R111 Composite Composite .05M EDTA	124.169	180.861	22.457	7.59	42.080	0.319	1.42%
R111-2 Composite Pore#1 .05M CIT(5)	150.237	188.124	28.263	0.89	38.280	0.034	0.12%
R111-2 Composite Pore#2 .05M CIT(5)	150.237	188.124	28.263	1.48	38.280	0.057	0.20%
R111-2 Composite Pore#3 .05M CIT(5)	150.237	188.124	28.263	1.07	38.280	0.041	0.14%
R111-2 Composite Pore#4 .05M CIT(5)	150.237	188.124	28.263	1.41	38.280	0.054	0.19%
R111-2 Composite Pore#5 .05M CIT(5)	150.237	188.124	28.263	1.38	38.280	0.053	0.19%
R111-2 Composite Pore#6 .05M CIT(5)	150.237	188.124	28.263	1.67	38.280	0.064	0.23%
R111-2 Composite Pore#7 .05M CIT(5)	150.237	188.124	28.263	1.18	38.280	0.045	0.16%
R111-2 Composite Pore#8 .05M CIT(5)	150.237	188.124	28.263	1.11	38.280	0.042	0.15%
R111-2 Composite Composite .05M CIT(5)	150.237	188.124	28.263	1.62	38.280	0.062	0.22%
R111-2 Composite Drainage .05M CIT(5)	150.237	188.124	28.263	2.81	38.280	0.108	0.38%
R111-2 Composite Pore#1 Dist. H2O(5)	150.237	188.124	28.263	1.15	38.280	0.044	0.16%
R111-2 Composite Pore#2 Dist. H2O(5)	150.237	188.124	28.263	0.45	38.280	0.017	0.06%
R111-2 Composite Pore#3 Dist. H2O(5)	150.237	188.124	28.263	0.56	38.280	0.021	0.08%
R111-2 Composite Pore#4 Dist. H2O(5)	150.237	188.124	28.263	1.11	38.280	0.042	0.15%
R111-2 Composite Pore#5 Dist. H2O(5)	150.237	188.124	28.263	0.25	38.280	0.010	0.03%
R111-2 Composite Drainage Dist. H2O(5)	150.237	188.124	28.263	0.25	38.280	0.010	0.03%
R111-2 Composite Composite Dist. H2O(5)	150.237	188.124	28.263	0.33	38.280	0.013	0.04%
R111-3 Composite Pore#1 .05M CIT(5)	74.351	310.567	23.091	0.67	87.720	0.059	0.25%
R111-3 Composite Pore#2 .05M CIT(5)	74.351	310.567	23.091	0.25	87.720	0.022	0.09%
R111-3 Composite Pore#3 .05M CIT(5)	74.351	310.567	23.091	0.56	87.720	0.049	0.21%
R111-3 Composite Pore#4 .05M CIT(5)	74.351	310.567	23.091	1.02	87.720	0.089	0.39%
R111-3 Composite Pore#5 .05M CIT(5)	74.351	310.567	23.091	1.81	87.720	0.159	0.69%
R111-3 Composite Pore#6 .05M CIT(5)	74.351	310.567	23.091	0.81	87.720	0.071	0.31%
R111-3 Composite Pore#7 .05M CIT(5)	74.351	310.567	23.091	2.27	87.720	0.199	0.86%
R111-3 Composite Drainage .05M CIT(5)	74.351	310.567	23.091	1.91	87.720	0.168	0.73%
R111-3 Composite Composite .05M CIT(5)	74.351	310.567	23.091	1.66	87.720	0.146	0.63%
R111-3 Composite Pore#1 Dist. H2O(5)	74.351	310.567	23.091	0.25	87.840	0.022	0.10%
R111-3 Composite Pore#2 Dist. H2O(5)	74.351	310.567	23.091	0.35	87.840	0.031	0.13%
R111-3 Composite Pore#3 Dist. H2O(5)	74.351	310.567	23.091	0.25	87.840	0.022	0.10%
R111-3 Composite Pore#4 Dist. H2O(5)	74.351	310.567	23.091	0.45	87.840	0.040	0.17%

Pb Removed by Columnar Flooding

SAMPLE	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pore Volume (ml)	Pb in Sample (mg)	% Pb Removed
R111-3 Composite Pore#5 Dist. H2O(5)	74.351	310.567	23.091	0.57	87.840	0.050	0.22%
R111-3 Composite Drainage Dist. H2O(5)	74.351	310.567	23.091	0.35	87.840	0.031	0.13%
R111-3 Composite Composite Dist. H2O(5)	74.351	310.567	23.091	0.25	87.840	0.022	0.10%
R111-4 Composite Pore#1 .05M CIT(5)	98.018	206.100	20.202	0.82	53.550	0.044	0.22%
R111-4 Composite Pore#2 .05M CIT(5)	98.018	206.100	20.202	1.38	53.550	0.074	0.37%
R111-4 Composite Pore#3 .05M CIT(5)	98.018	206.100	20.202	0.81	53.550	0.043	0.21%
R111-4 Composite Pore#4 .05M CIT(5)	98.018	206.100	20.202	1.66	53.550	0.089	0.44%
R111-4 Composite Pore#5 .05M CIT(5)	98.018	206.100	20.202	2.10	53.550	0.112	0.56%
R111-4 Composite Pore#6 .05M CIT(5)	98.018	206.100	20.202	1.15	53.550	0.062	0.30%
R111-4 Composite Pore#7 .05M CIT(5)	98.018	206.100	20.202	2.06	53.550	0.110	0.55%
R111-4 Composite Pore#8 .05M CIT(5)	98.018	206.100	20.202	1.49	53.550	0.080	0.39%
R111-4 Composite Drainage .05M CIT(5)	98.018	206.100	20.202	1.02	53.550	0.055	0.27%
R111-4 Composite Composite .05M CIT(5)	98.018	206.100	20.202	1.30	53.550	0.070	0.34%
R111-4 Composite Pore#1 Dist. H2O(5)	98.018	206.100	20.202	0.35	53.770	0.019	0.09%
R111-4 Composite Pore#2 Dist. H2O(5)	98.018	206.100	20.202	0.25	53.770	0.013	0.07%
R111-4 Composite Pore#3 Dist. H2O(5)	98.018	206.100	20.202	0.25	53.770	0.013	0.07%
R111-4 Composite Pore#4 Dist. H2O(5)	98.018	206.100	20.202	0.25	53.770	0.013	0.07%
R111-4 Composite Pore#5 Dist. H2O(5)	98.018	206.100	20.202	0.25	53.770	0.013	0.07%
R111-4 Composite Drainage Dist. H2O(5)	98.018	206.100	20.202	0.25	53.770	0.013	0.07%
R111-4 Composite Composite Dist. H2O(5)	98.018	206.100	20.202	0.25	53.770	0.013	0.07%
R111-4,3 Composite Pore#1 .05M CIT(5)	137.333	199.903	27.453	0.67	73.348	0.049	0.18%
R111-4,3 Composite Pore#2 .05M CIT(5)	137.333	199.903	27.453	0.79	73.348	0.058	0.21%
R111-4,3 Composite Pore#3 .05M CIT(5)	137.333	199.903	27.453	2.01	73.348	0.147	0.54%
R111-4,3 Composite Pore#4 .05M CIT(5)	137.333	199.903	27.453	3.00	73.348	0.220	0.80%
R111-4,3 Composite Pore#5 .05M CIT(5)	137.333	199.903	27.453	3.30	73.348	0.242	0.88%
R111-4,3 Composite Pore#6 .05M CIT(5)	137.333	199.903	27.453	2.80	73.348	0.205	0.75%
R111-4,3 Composite Pore#7 .05M CIT(5)	137.333	199.903	27.453	15.92	73.348	1.168	4.25%
R111-4,3 Composite Pore#8 .05M CIT(5)	137.333	199.903	27.453	3.48	73.348	0.255	0.93%
R111-4,3 Composite Drainage .05M CIT(5)	137.333	199.903	27.453	2.84	73.348	0.208	0.76%
R111-4,3 Composite Composite .05M CIT(5)	137.333	199.903	27.453	2.50	73.348	0.183	0.67%
R111-4,3 Composite Pore#1 Dist. H2O(5)	137.333	199.903	27.453	0.25	73.348	0.018	0.07%
R111-4,3 Composite Pore#2 Dist. H2O(5)	137.333	199.903	27.453	0.25	73.348	0.018	0.07%
R111-4,3 Composite Pore#3 Dist. H2O(5)	137.333	199.903	27.453	0.25	73.348	0.018	0.07%

Pb Removed by Columnar Flooding

SAMPLE	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pore Volume (ml)	Pb in Sample (mg)	% Pb Removed
R111-4,3 Composite Pore#4 Dist. H2O(5)	137.333	199.903	27.453	0.25	73.348	0.018	0.07%
R111-4,3 Composite Pore#5 Dist. H2O(5)	137.333	199.903	27.453	0.25	73.348	0.018	0.07%
R111-4,3 Composite Drainage Dist. H2O(5)	137.333	199.903	27.453	0.25	73.348	0.018	0.07%
R111-4,3 Composite Composite Dist. H2O(5)	137.333	199.903	27.453	0.25	73.348	0.018	0.07%
R122 Composite Pore #1 Dist. H2O	398.929	312.096	124.504	1.56	69.600	0.109	0.09%
R122 Composite Pore #2 Dist. H2O	398.929	312.096	124.504	1.40	69.600	0.097	0.08%
R122 Composite Pore #3 Dist. H2O	398.929	312.096	124.504	0.62	69.600	0.043	0.03%
R122 Composite Pore #4 Dist. H2O	398.929	312.096	124.504	0.50	69.600	0.035	0.03%
R122 Composite Pore #5 Dist. H2O	398.929	312.096	124.504	0.47	69.600	0.033	0.03%
R122 Composite Drainage Dist. H2O	398.929	312.096	124.504	1.53	69.600	0.106	0.09%
R122 Composite Composite Dist. H2O	398.929	312.096	124.504	0.92	69.600	0.064	0.05%
R122 Composite Pore #1 .05M EDTA	398.929	312.096	124.504	2.01	69.600	0.140	0.11%
R122 Composite Pore #2 .05M EDTA	398.929	312.096	124.504	51.21	69.600	3.564	2.86%
R122 Composite Pore #3 .05M EDTA	398.929	312.096	124.504	214.91	69.600	14.958	12.01%
R122 Composite Pore #4 .05M EDTA	398.929	312.096	124.504	196.01	69.600	13.642	10.96%
R122 Composite Pore #5 .05M EDTA	398.929	312.096	124.504	118.67	69.600	8.259	6.63%
R122 Composite Pore #6 .05M EDTA	398.929	312.096	124.504	80.92	69.600	5.632	4.52%
R122 Composite Pore #7 .05M EDTA	398.929	312.096	124.504	55.04	69.600	3.831	3.08%
R122 Composite Pore #8 .05M EDTA	398.929	312.096	124.504	43.86	69.600	3.053	2.45%
R122 Composite Drainage .05M EDTA	398.929	312.096	124.504	33.60	69.600	2.339	1.88%
R122 Composite Composite .05M EDTA	398.929	312.096	124.504	108.64	69.600	7.561	6.07%
R124 Composite Pore#1 .05M EDTA(5)	8106.044	342.551	2776.730	778.49	55.770	43.416	1.56%
R124 Composite Pore#2 .05M EDTA(5)	8106.044	342.551	2776.730	829.36	55.770	46.253	1.67%
R124 Composite Pore#3 .05M EDTA(5)	8106.044	342.551	2776.730	770.75	55.770	42.985	1.55%
R124 Composite Pore#4 .05M EDTA(5)	8106.044	342.551	2776.730	811.64	55.770	45.265	1.63%
R124 Composite Pore#5 .05M EDTA(5)	8106.044	342.551	2776.730	505.85	55.770	28.211	1.02%
R124 Composite Pore#6 .05M EDTA(5)	8106.044	342.551	2776.730	436.48	55.770	24.342	0.88%
R124 Composite Pore#7 .05M EDTA(5)	8106.044	342.551	2776.730	348.82	55.770	19.454	0.70%
R124 Composite Pore#8 .05M EDTA(5)	8106.044	342.551	2776.730	309.67	55.770	17.270	0.62%
R124 Composite Drainage .05M EDTA(5)	8106.044	342.551	2776.730	315.88	55.770	17.617	0.63%
R124 Composite Composite .05M EDTA(5)	8106.044	342.551	2776.730	567.00	55.770	31.622	1.14%
R124 Composite Pore#1 Dist. H2O(5)	8106.044	342.551	2776.730	2.94	55.770	0.164	0.01%
R124 Composite Pore#2 Dist. H2O(5)	8106.044	342.551	2776.730	3.90	55.770	0.218	0.01%

Pb Removed by Columnar Flooding

SAMPLE	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pore Volume (ml)	Pb in Sample (mg)	% Pb Removed
R124 Composite Pore#3 Dist. H2O(5)	8106.044	342.551	2776.730	3.20	55.770	0.178	0.01%
R124 Composite Pore#4 Dist. H2O(5)	8106.044	342.551	2776.730	2.30	55.770	0.128	0.00%
R124 Composite Pore#5 Dist. H2O(5)	8106.044	342.551	2776.730	2.22	55.770	0.124	0.00%
R124 Composite Composite Dist. H2O(5)	8106.044	342.551	2776.730	3.07	55.770	0.171	0.01%
R124 Composite Drainage Dist. H2O(5)	8106.044	342.551	2776.730	3.39	55.770	0.189	0.01%
R124-2 Composite Pore#1 .05M CIT(5)	8155.602	312.744	2550.618	38.56	46.880	1.808	0.07%
R124-2 Composite Pore#2 .05M CIT(5)	8155.602	312.744	2550.618	103.11	46.880	4.834	0.19%
R124-2 Composite Pore#3 .05M CIT(5)	8155.602	312.744	2550.618	117.98	46.880	5.531	0.22%
R124-2 Composite Pore#4 .05M CIT(5)	8155.602	312.744	2550.618	128.88	46.880	6.042	0.24%
R124-2 Composite Pore#5 .05M CIT(5)	8155.602	312.744	2550.618	132.99	46.880	6.235	0.24%
R124-2 Composite Pore#6 .05M CIT(5)	8155.602	312.744	2550.618	120.70	46.880	5.658	0.22%
R124-2 Composite Pore#7 .05M CIT(5)	8155.602	312.744	2550.618	167.76	46.880	7.865	0.31%
R124-2 Composite Pore#8 .05M CIT(5)	8155.602	312.744	2550.618	155.14	46.880	7.273	0.29%
R124-2 Composite Composite .05M CIT(5)	8155.602	312.744	2550.618	126.15	46.880	5.914	0.23%
R124-2 Composite Drainage .05M CIT(5)	8155.602	312.744	2550.618	159.33	46.880	7.469	0.29%
R124-2 Composite Pore#1 Dist. H2O(5)	8155.602	312.744	2550.618	14.36	46.880	0.673	0.03%
R124-2 Composite Pore#2 Dist. H2O(5)	8155.602	312.744	2550.618	10.83	46.880	0.508	0.02%
R124-2 Composite Pore#3 Dist. H2O(5)	8155.602	312.744	2550.618	4.70	46.880	0.220	0.01%
R124-2 Composite Pore#4 Dist. H2O(5)	8155.602	312.744	2550.618	3.45	46.880	0.162	0.01%
R124-2 Composite Pore#5 Dist. H2O(5)	8155.602	312.744	2550.618	4.15	46.880	0.195	0.01%
R124-2 Composite Composite Dist. H2O(5)	8155.602	312.744	2550.618	5.24	46.880	0.246	0.01%
R124-2 Composite Drainage Dist. H2O(5)	8155.602	312.744	2550.618	3.80	46.880	0.178	0.01%
R124-3 Composite Pore#1 .05M CIT(5)	28129.324	213.391	6002.539	5.86	63.700	0.373	0.01%
R124-3 Composite Pore#2 .05M CIT(5)	28129.324	213.391	6002.539	103.15	63.700	6.571	0.11%
R124-3 Composite Pore#3 .05M CIT(5)	28129.324	213.391	6002.539	194.78	63.700	12.407	0.21%
R124-3 Composite Pore#4 .05M CIT(5)	28129.324	213.391	6002.539	190.48	63.700	12.134	0.20%
R124-3 Composite Pore#5 .05M CIT(5)	28129.324	213.391	6002.539	181.92	63.700	11.588	0.19%
R124-3 Composite Pore#6 .05M CIT(5)	28129.324	213.391	6002.539	167.76	63.700	10.686	0.18%
R124-3 Composite Pore#7 .05M CIT(5)	28129.324	213.391	6002.539	160.73	63.700	10.239	0.17%
R124-3 Composite Pore#8 .05M CIT(5)	28129.324	213.391	6002.539	160.73	63.700	10.239	0.17%
R124-3 Composite Composite .05M CIT(5)	28129.324	213.391	6002.539	149.06	63.700	9.495	0.16%
R124-3 Composite Drainage .05M CIT(5)	28129.324	213.391	6002.539	134.70	63.700	8.580	0.14%
R124-3 Composite Pore#1 Dist. H2O(5)	28129.324	213.391	6002.539	1.59	63.750	0.101	0.00%

Pb Removed by Columnar Flooding

SAMPLE	Pb (mg/kg)	Wt. of Soil (g)	Pb in Soil (mg)	Pb (mg/L)	Pore Volume (ml)	Pb in Sample (mg)	% Pb Removed
R124-3 Composite Pore#2 Dist. H2O(5)	28129.324	213.391	6002.539	0.83	63.750	0.053	0.00%
R124-3 Composite Pore#3 Dist. H2O(5)	28129.324	213.391	6002.539	1.80	63.750	0.115	0.00%
R124-3 Composite Pore#4 Dist. H2O(5)	28129.324	213.391	6002.539	0.94	63.750	0.060	0.00%
R124-3 Composite Pore#5 Dist. H2O(5)	28129.324	213.391	6002.539	3.67	63.750	0.234	0.00%
R124-3 Composite Composite Dist. H2O(5)	28129.324	213.391	6002.539	0.83	63.750	0.053	0.00%
R124-3 Composite Drainage Dist. H2O(5)	28129.324	213.391	6002.539	1.16	63.750	0.074	0.00%

Zn Removed by Columnar Flooding

SAMPLE	Zn (mg/kg)	Wt. of Soil (g)	Zn in Soil (mg)	Zn (mg/L)	Pore Volume (ml)	Zn in Sample (mg)	% Zn Removed
R111-2 Composite Pore#1 .05M CIT(5)	1867.823	188.124	351.383	31.84	38.280	1.219	0.35%
R111-2 Composite Pore#2 .05M CIT(5)	1867.823	188.124	351.383	7.32	38.280	0.280	0.08%
R111-2 Composite Pore#3 .05M CIT(5)	1867.823	188.124	351.383	9.06	38.280	0.347	0.10%
R111-2 Composite Pore#4 .05M CIT(5)	1867.823	188.124	351.383	10.51	38.280	0.402	0.11%
R111-2 Composite Pore#5 .05M CIT(5)	1867.823	188.124	351.383	8.18	38.280	0.313	0.09%
R111-2 Composite Pore#6 .05M CIT(5)	1867.823	188.124	351.383	7.78	38.280	0.298	0.08%
R111-2 Composite Pore#7 .05M CIT(5)	1867.823	188.124	351.383	6.76	38.280	0.259	0.07%
R111-2 Composite Pore#8 .05M CIT(5)	1867.823	188.124	351.383	5.38	38.280	0.206	0.06%
R111-2 Composite Composite .05M CIT(5)	1867.823	188.124	351.383	8.87	38.280	0.340	0.10%
R111-2 Composite Drainage .05M CIT(5)	1867.823	188.124	351.383	10.83	38.280	0.415	0.12%
R111-2 Composite Pore#1 Dist. H2O(5)	1867.823	188.124	351.383	7.16	38.280	0.274	0.08%
R111-2 Composite Pore#2 Dist. H2O(5)	1867.823	188.124	351.383	6.58	38.280	0.252	0.07%
R111-2 Composite Pore#3 Dist. H2O(5)	1867.823	188.124	351.383	6.22	38.280	0.238	0.07%
R111-2 Composite Pore#4 Dist. H2O(5)	1867.823	188.124	351.383	6.74	38.280	0.258	0.07%
R111-2 Composite Pore#5 Dist. H2O(5)	1867.823	188.124	351.383	5.94	38.280	0.227	0.06%
R111-2 Composite Drainage Dist. H2O(5)	1867.823	188.124	351.383	6.29	38.280	0.241	0.07%
R111-2 Composite Composite Dist. H2O(5)	1867.823	188.124	351.383	5.54	38.280	0.212	0.06%
R111-3 Composite Pore#1 .05M CIT(5)	928.272	310.567	288.290	3.64	87.720	0.319	0.11%
R111-3 Composite Pore#2 .05M CIT(5)	928.272	310.567	288.290	35.13	87.720	3.082	1.07%
R111-3 Composite Pore#3 .05M CIT(5)	928.272	310.567	288.290	14.41	87.720	1.264	0.44%
R111-3 Composite Pore#4 .05M CIT(5)	928.272	310.567	288.290	15.29	87.720	1.341	0.47%
R111-3 Composite Pore#5 .05M CIT(5)	928.272	310.567	288.290	13.89	87.720	1.218	0.42%
R111-3 Composite Pore#6 .05M CIT(5)	928.272	310.567	288.290	10.10	87.720	0.886	0.31%
R111-3 Composite Pore#7 .05M CIT(5)	928.272	310.567	288.290	6.05	87.720	0.531	0.18%
R111-3 Composite Drainage .05M CIT(5)	928.272	310.567	288.290	16.87	87.720	1.480	0.51%
R111-3 Composite Composite .05M CIT(5)	928.272	310.567	288.290	11.45	87.720	1.004	0.35%
R111-3 Composite Pore#1 Dist. H2O(5)	928.272	310.567	288.290	3.94	87.840	0.346	0.12%
R111-3 Composite Pore#2 Dist. H2O(5)	928.272	310.567	288.290	4.77	87.840	0.419	0.15%
R111-3 Composite Pore#3 Dist. H2O(5)	928.272	310.567	288.290	2.16	87.840	0.190	0.07%
R111-3 Composite Pore#4 Dist. H2O(5)	928.272	310.567	288.290	3.39	87.840	0.298	0.10%
R111-3 Composite Pore#5 Dist. H2O(5)	928.272	310.567	288.290	1.34	87.840	0.118	0.04%
R111-3 Composite Drainage Dist. H2O(5)	928.272	310.567	288.290	3.43	87.840	0.301	0.10%
R111-3 Composite Composite Dist. H2O(5)	928.272	310.567	288.290	1.96	87.840	0.172	0.06%

Zn Removed by Columnar Flooding

SAMPLE	Zn (mg/kg)	Wt. of Soil (g)	Zn in Soil (mg)	Zn (mg/L)	Pore Volume (ml)	Zn in Sample (mg)	% Zn Removed
R111-4 Composite Pore#1 .05M CIT(5)	1697.747	206.100	349.906	43.12	53.550	2.309	0.66%
R111-4 Composite Pore#2 .05M CIT(5)	1697.747	206.100	349.906	9.01	53.550	0.482	0.14%
R111-4 Composite Pore#3 .05M CIT(5)	1697.747	206.100	349.906	9.29	53.550	0.497	0.14%
R111-4 Composite Pore#4 .05M CIT(5)	1697.747	206.100	349.906	7.72	53.550	0.413	0.12%
R111-4 Composite Pore#5 .05M CIT(5)	1697.747	206.100	349.906	48.26	53.550	2.584	0.74%
R111-4 Composite Pore#6 .05M CIT(5)	1697.747	206.100	349.906	44.61	53.550	2.389	0.68%
R111-4 Composite Pore#7 .05M CIT(5)	1697.747	206.100	349.906	42.98	53.550	2.302	0.66%
R111-4 Composite Pore#8 .05M CIT(5)	1697.747	206.100	349.906	42.15	53.550	2.257	0.65%
R111-4 Composite Drainage .05M CIT(5)	1697.747	206.100	349.906	47.21	53.550	2.528	0.72%
R111-4 Composite Composite .05M CIT(5)	1697.747	206.100	349.906	74.58	53.550	3.994	1.14%
R111-4 Composite Pore#1 Dist. H2O(5)	1697.747	206.100	349.906	7.25	53.770	0.390	0.11%
R111-4 Composite Pore#2 Dist. H2O(5)	1697.747	206.100	349.906	9.06	53.770	0.487	0.14%
R111-4 Composite Pore#3 Dist. H2O(5)	1697.747	206.100	349.906	6.50	53.770	0.350	0.10%
R111-4 Composite Pore#4 Dist. H2O(5)	1697.747	206.100	349.906	3.22	53.770	0.173	0.05%
R111-4 Composite Pore#5 Dist. H2O(5)	1697.747	206.100	349.906	5.57	53.770	0.299	0.09%
R111-4 Composite Drainage Dist. H2O(5)	1697.747	206.100	349.906	4.43	53.770	0.238	0.07%
R111-4 Composite Composite Dist. H2O(5)	1697.747	206.100	349.906	7.48	53.770	0.402	0.11%
R111-4,3 Composite Pore#1 .05M CIT(5)	757.267	199.903	151.380	4.71	73.348	0.345	0.23%
R111-4,3 Composite Pore#2 .05M CIT(5)	757.267	199.903	151.380	36.33	73.348	2.665	1.76%
R111-4,3 Composite Pore#3 .05M CIT(5)	757.267	199.903	151.380	78.08	73.348	5.727	3.78%
R111-4,3 Composite Pore#4 .05M CIT(5)	757.267	199.903	151.380	48.86	73.348	3.584	2.37%
R111-4,3 Composite Pore#5 .05M CIT(5)	757.267	199.903	151.380	41.71	73.348	3.059	2.02%
R111-4,3 Composite Pore#6 .05M CIT(5)	757.267	199.903	151.380	39.69	73.348	2.911	1.92%
R111-4,3 Composite Pore#7 .05M CIT(5)	757.267	199.903	151.380	40.83	73.348	2.995	1.98%
R111-4,3 Composite Pore#8 .05M CIT(5)	757.267	199.903	151.380	40.36	73.348	2.960	1.96%
R111-4,3 Composite Drainage .05M CIT(5)	757.267	199.903	151.380	37.37	73.348	2.741	1.81%
R111-4,3 Composite Composite .05M CIT(5)	757.267	199.903	151.380	39.14	73.348	2.871	1.90%
R111-4,3 Composite Pore#1 Dist. H2O(5)	757.267	199.903	151.380	6.77	73.348	0.497	0.33%
R111-4,3 Composite Pore#2 Dist. H2O(5)	757.267	199.903	151.380	4.64	73.348	0.340	0.22%
R111-4,3 Composite Pore#3 Dist. H2O(5)	757.267	199.903	151.380	4.78	73.348	0.351	0.23%
R111-4,3 Composite Pore#4 Dist. H2O(5)	757.267	199.903	151.380	4.18	73.348	0.307	0.20%
R111-4,3 Composite Pore#5 Dist. H2O(5)	757.267	199.903	151.380	1.77	73.348	0.130	0.09%
R111-4,3 Composite Drainage Dist. H2O(5)	757.267	199.903	151.380	4.96	73.348	0.364	0.24%

Zn Removed by Columnar Flooding

SAMPLE	Zn (mg/kg)	Wt. of Soil (g)	Zn in Soil (mg)	Zn (mg/L)	Pore Volume (ml)	Zn in Sample (mg)	% Zn Removed
R111-4,3 Composite Composite Dist. H2O(5)	757.267	199.903	151.380	3.38	73.348	0.248	0.16%
R124 Composite Pore#1 .05M EDTA(5)	436.563	342.551	149.545	13.43	55.770	0.749	0.50%
R124 Composite Pore#2 .05M EDTA(5)	436.563	342.551	149.545	16.83	55.770	0.939	0.63%
R124 Composite Pore#3 .05M EDTA(5)	436.563	342.551	149.545	14.67	55.770	0.818	0.55%
R124 Composite Pore#4 .05M EDTA(5)	436.563	342.551	149.545	11.55	55.770	0.644	0.43%
R124 Composite Pore#5 .05M EDTA(5)	436.563	342.551	149.545	11.04	55.770	0.616	0.41%
R124 Composite Pore#6 .05M EDTA(5)	436.563	342.551	149.545	12.84	55.770	0.716	0.48%
R124 Composite Pore#7 .05M EDTA(5)	436.563	342.551	149.545	13.76	55.770	0.767	0.51%
R124 Composite Pore#8 .05M EDTA(5)	436.563	342.551	149.545	10.92	55.770	0.609	0.41%
R124 Composite Drainage .05M EDTA(5)	436.563	342.551	149.545	12.04	55.770	0.671	0.45%
R124 Composite Composite .05M EDTA(5)	436.563	342.551	149.545	13.47	55.770	0.751	0.50%
R124 Composite Pore#1 Dist. H2O(5)	436.563	342.551	149.545	4.48	55.770	0.250	0.17%
R124 Composite Pore#2 Dist. H2O(5)	436.563	342.551	149.545	3.07	55.770	0.171	0.11%
R124 Composite Pore#3 Dist. H2O(5)	436.563	342.551	149.545	6.89	55.770	0.384	0.26%
R124 Composite Pore#4 Dist. H2O(5)	436.563	342.551	149.545	3.39	55.770	0.189	0.13%
R124 Composite Pore#5 Dist. H2O(5)	436.563	342.551	149.545	4.06	55.770	0.226	0.15%
R124 Composite Composite Dist. H2O(5)	436.563	342.551	149.545	5.52	55.770	0.308	0.21%
R124 Composite Drainage Dist. H2O(5)	436.563	342.551	149.545	6.19	55.770	0.345	0.23%
R124-2 Composite Pore#1 .05M CIT(5)	146.954	312.744	45.959	7.57	46.880	0.355	0.77%
R124-2 Composite Pore#2 .05M CIT(5)	146.954	312.744	45.959	8.39	46.880	0.393	0.86%
R124-2 Composite Pore#3 .05M CIT(5)	146.954	312.744	45.959	9.66	46.880	0.453	0.99%
R124-2 Composite Pore#4 .05M CIT(5)	146.954	312.744	45.959	6.01	46.880	0.282	0.61%
R124-2 Composite Pore#5 .05M CIT(5)	146.954	312.744	45.959	9.22	46.880	0.432	0.94%
R124-2 Composite Pore#6 .05M CIT(5)	146.954	312.744	45.959	8.07	46.880	0.378	0.82%
R124-2 Composite Pore#7 .05M CIT(5)	146.954	312.744	45.959	5.77	46.880	0.270	0.59%
R124-2 Composite Pore#8 .05M CIT(5)	146.954	312.744	45.959	7.41	46.880	0.347	0.76%
R124-2 Composite Composite .05M CIT(5)	146.954	312.744	45.959	6.10	46.880	0.286	0.62%
R124-2 Composite Drainage .05M CIT(5)	146.954	312.744	45.959	21.78	46.880	1.021	2.22%
R124-2 Composite Pore#1 Dist. H2O(5)	146.954	312.744	45.959	12.01	46.880	0.563	1.23%
R124-2 Composite Pore#2 Dist. H2O(5)	146.954	312.744	45.959	3.58	46.880	0.168	0.37%
R124-2 Composite Pore#3 Dist. H2O(5)	146.954	312.744	45.959	4.08	46.880	0.191	0.42%
R124-2 Composite Pore#4 Dist. H2O(5)	146.954	312.744	45.959	3.23	46.880	0.151	0.33%
R124-2 Composite Pore#5 Dist. H2O(5)	146.954	312.744	45.959	5.02	46.880	0.235	0.51%

Zn Removed by Columnar Flooding

SAMPLE	Zn (mg/kg)	Wt. of Soil (g)	Zn in Soil (mg)	Zn (mg/L)	Pore Volume (ml)	Zn in Sample (mg)	% Zn Removed
R124-2 Composite Composite Dist. H2O(5)	146.954	312.744	45.959	3.54	46.880	0.166	0.36%
R124-2 Composite Drainage Dist. H2O(5)	146.954	312.744	45.959	2.67	46.880	0.125	0.27%
R124-3 Composite Pore#1 .05M CIT(5)	140.024	213.391	29.880	4.98	63.700	0.317	1.06%
R124-3 Composite Pore#2 .05M CIT(5)	140.024	213.391	29.880	15.38	63.700	0.980	3.28%
R124-3 Composite Pore#3 .05M CIT(5)	140.024	213.391	29.880	18.01	63.700	1.147	3.84%
R124-3 Composite Pore#4 .05M CIT(5)	140.024	213.391	29.880	11.63	63.700	0.741	2.48%
R124-3 Composite Pore#5 .05M CIT(5)	140.024	213.391	29.880	15.88	63.700	1.012	3.39%
R124-3 Composite Pore#6 .05M CIT(5)	140.024	213.391	29.880	6.59	63.700	0.420	1.40%
R124-3 Composite Pore#7 .05M CIT(5)	140.024	213.391	29.880	11.83	63.700	0.754	2.52%
R124-3 Composite Pore#8 .05M CIT(5)	140.024	213.391	29.880	10.01	63.700	0.638	2.13%
R124-3 Composite Composite .05M CIT(5)	140.024	213.391	29.880	9.42	63.700	0.600	2.01%
R124-3 Composite Drainage .05M CIT(5)	140.024	213.391	29.880	8.61	63.700	0.548	1.84%
R124-3 Composite Pore#1 Dist. H2O(5)	140.024	213.391	29.880	2.31	63.750	0.147	0.49%
R124-3 Composite Pore#2 Dist. H2O(5)	140.024	213.391	29.880	1.58	63.750	0.101	0.34%
R124-3 Composite Pore#3 Dist. H2O(5)	140.024	213.391	29.880	1.77	63.750	0.113	0.38%
R124-3 Composite Pore#4 Dist. H2O(5)	140.024	213.391	29.880	3.22	63.750	0.205	0.69%
R124-3 Composite Pore#5 Dist. H2O(5)	140.024	213.391	29.880	2.91	63.750	0.186	0.62%
R124-3 Composite Composite Dist. H2O(5)	140.024	213.391	29.880	1.62	63.750	0.103	0.35%
R124-3 Composite Drainage Dist. H2O(5)	140.024	213.391	29.880	4.37	63.750	0.279	0.93%

Appendix C:

**Percent of Heavy Metals Removed by
Columnar Flooding: Cd, Cr, Cu, Fe, Pb, and Zn**

% Cd Removed by Columnar Flooding

Sample	Pore # 1	Pore # 2	Pore # 3	Pore # 4	Pore # 5	Pore # 6	Pore # 7	Pore # 8	Drainage	Composite	TOTAL % REMOVED
R111-2 Composite Dist. H2O	0.02%	0.02%	0.02%	0.02%	0.02%				0.02%	0.02%	0.14%
R111-2 Composite .05M Cit.	0.05%	0.30%	0.22%	0.15%	0.13%	0.08%	0.05%	0.03%	0.16%	0.16%	1.33%
R111-3 Composite Dist. H2O	0.10%	0.10%	0.10%	0.10%	0.10%				0.10%	0.10%	0.70%
R111-3 Composite .05M Cit.	0.10%	0.22%	1.63%	1.73%	0.24%	0.16%	1.09%		0.97%	0.63%	6.77%
R111-4 Composite Dist. H2O	0.05%	0.05%	0.05%	0.05%	0.05%				0.05%	0.05%	0.35%
R111-4 Composite .05M Cit.	0.12%	0.39%	0.32%	0.12%	0.05%	0.05%	0.05%	0.05%	0.05%	0.06%	1.26%
R111-4,3 Composite Dist. H2O	0.02%	0.02%	0.02%	0.02%	0.02%				0.02%	0.02%	0.14%
R111-4,3 Composite .05M Cit.	0.10%	4.89%	7.27%	5.80%	3.98%	3.13%	2.46%	2.67%	0.88%	3.53%	34.71%
R124 Composite Dist. H2O	1.30%	1.30%	1.30%	1.30%	1.30%				1.30%	1.30%	9.10%
R124 Composite .05M EDTA	1.30%	1.30%	1.30%	1.30%	1.30%	1.30%	1.30%	1.30%	1.30%	1.30%	13.00%
R124-2 Composite Dist. H2O	1.58%	1.58%	1.58%	1.58%	1.58%				1.58%	1.58%	11.06%
R124-2 Composite .05M Cit	1.58%	1.58%	1.58%	1.58%	1.58%	1.58%	1.58%	1.58%	1.58%	1.58%	15.80%
R124-3 Composite Dist. H2O	0.65%	0.65%	0.65%	0.65%	0.65%				0.65%	0.65%	4.55%
R124-3 Composite .05M Cit	0.65%	0.65%	0.65%	0.65%	0.65%	0.65%	0.65%	0.65%	0.65%	0.65%	6.50%
AVERAGE REMOVAL FOR DIST. H2O	3.72%										
AVERAGE REMOVAL FOR CITRIC ACID	11.06%										
AVERAGE REMOVAL FOR EDTA	13.00%										

% Cr Removed by Columnar Flooding

Sample	Pore #1	Pore #2	Pore #3	Pore #4	Pore #5	Pore #6	Pore #7	Pore #8	Drainage	Composite	TOTAL % REMOVED
R111-2 Composite Dist. H2O	0.07%	0.07%	0.07%	0.07%	0.07%				0.07%	0.07%	0.49%
R111-2 Composite .05M Cit.	0.07%	0.07%	0.07%	0.07%	0.07%	0.07%	0.07%	0.07%	0.09%	0.07%	0.72%
R111-3 Composite Dist. H2O	0.07%	0.07%	0.07%	0.07%	0.07%				0.07%	0.07%	0.49%
R111-3 Composite .05M Cit.	0.07%	0.07%	0.08%	0.11%	0.12%	0.11%	0.12%		0.15%	0.10%	0.93%
R111-4 Composite Dist. H2O	0.10%	0.10%	0.10%	0.10%	0.10%				0.10%	0.10%	0.70%
R111-4 Composite .05M Cit.	0.10%	0.10%	0.12%	0.16%	0.10%	0.10%	0.10%	0.10%	0.10%	0.10%	1.08%
R111-4,3 Composite Dist. H2O	0.14%	0.14%	0.14%	0.14%	0.14%				0.14%	0.14%	0.98%
R111-4,3 Composite .05M Cit.	0.14%	0.14%	0.22%	0.21%	0.21%	0.22%	0.26%	0.24%	0.26%	0.19%	2.09%
R124 Composite Dist. H2O	0.28%	0.28%	0.28%	0.28%	0.28%				0.28%	0.28%	1.96%
R124 Composite .05M EDTA	0.28%	0.28%	0.28%	0.28%	0.28%	0.28%	0.28%	0.28%	0.28%	0.28%	2.80%
R124-2 Composite Dist. H2O	0.28%	0.28%	0.28%	0.28%	0.28%				0.28%	0.28%	1.96%
R124-2 Composite .05M Cit	0.28%	0.28%	0.28%	0.28%	0.28%	0.28%	0.28%	0.28%	0.28%	0.28%	2.80%
R124-3 Composite Dist. H2O	0.66%	0.66%	0.66%	0.66%	0.66%				0.66%	0.66%	4.62%
R124-3 Composite .05M Cit	0.66%	0.66%	0.66%	0.66%	0.66%	0.66%	0.66%	0.66%	0.66%	0.66%	6.60%
AVERAGE REMOVAL FOR DIST. H2O	1.60%										
AVERAGE REMOVAL FOR CITRIC ACID	2.37%										
AVERAGE REMOVAL FOR EDTA	2.80%										

% Cu Removed by Columnar Flooding

Sample	Pore #1	Pore #2	Pore #3	Pore #4	Pore #5	Pore #6	Pore #7	Pore #8	Drainage	Composite	TOTAL % REMOVED
R111-2 Composite Dist. H2O	0.04%	0.04%	0.05%	0.04%	0.02%				0.02%	0.03%	0.24%
R111-2 Composite .05M Cit.	0.22%	0.46%	0.45%	0.45%	0.45%	0.39%	0.34%	0.31%	0.57%	0.47%	4.11%
R111-3 Composite Dist. H2O	0.04%	0.03%	0.03%	0.04%	0.03%				0.02%	0.03%	0.22%
R111-3 Composite .05M Cit.	0.11%	1.47%	1.47%	2.10%	2.09%	1.65%	1.47%		1.17%	1.67%	13.20%
R111-4 Composite Dist. H2O	0.06%	0.08%	0.05%	0.04%	0.03%				0.03%	0.04%	0.33%
R111-4 Composite .05M Cit.	0.79%	1.16%	1.15%	0.85%	0.69%	0.58%	0.53%	0.53%	1.38%	0.89%	8.55%
R111-4,3 Composite Dist. H2O	0.03%	0.04%	0.04%	0.03%	0.03%				0.03%	0.04%	0.24%
R111-4,3 Composite .05M Cit.	0.62%	3.01%	2.49%	1.84%	1.46%	1.15%	1.21%	1.42%	1.09%	1.67%	15.96%
R124 Composite Dist. H2O	0.00%	0.00%	0.00%	0.00%	0.00%				0.00%	0.00%	0.00%
R124 Composite .05M EDTA	0.17%	0.18%	0.17%	0.16%	0.13%	0.13%	0.11%	0.11%	0.11%	0.14%	1.41%
R124-2 Composite Dist. H2O	0.04%	0.03%	0.01%	0.01%	0.01%				0.02%	0.01%	0.13%
R124-2 Composite .05M Cit	0.37%	0.57%	0.44%	0.44%	0.49%	0.61%	0.62%	0.56%	0.47%	0.49%	5.06%
R124-3 Composite Dist. H2O	0.05%	0.04%	0.04%	0.04%	0.04%				0.03%	0.04%	0.28%
R124-3 Composite .05M Cit	0.08%	0.70%	1.14%	0.87%	0.73%	0.72%	0.70%	0.62%	0.56%	0.76%	6.88%
AVERAGE REMOVAL FOR DIST. H2O	0.21%										
AVERAGE REMOVAL FOR CITRIC ACID	8.96%										
AVERAGE REMOVAL FOR EDTA	1.41%										

% Fe Removed by Columnar Flooding

Sample	Pore # 1	Pore # 2	Pore # 3	Pore # 4	Pore # 5	Pore # 6	Pore # 7	Pore # 8	Drainage	Composite	TOTAL % REMOVED
R111-2 Composite Dist. H2O	0.01%	0.01%	0.01%	0.02%	0.02%				0.01%	0.01%	0.09%
R111-2 Composite .05M Cit.	0.01%	0.01%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.05%	0.02%	0.21%
R111-3 Composite Dist. H2O	0.00%	0.00%	0.00%	0.00%	0.00%				0.00%	0.00%	0.00%
R111-3 Composite .05M Cit.	0.00%	0.01%	0.02%	0.03%	0.04%	0.04%	0.06%		0.06%	0.04%	0.30%
R111-4 Composite Dist. H2O	0.00%	0.00%	0.00%	0.00%	0.00%				0.00%	0.00%	0.00%
R111-4 Composite .05M Cit.	0.01%	0.02%	0.02%	0.02%	0.03%	0.03%	0.03%	0.03%	0.02%	0.02%	0.23%
R111-4,3 Composite Dist. H2O	0.01%	0.00%	0.00%	0.00%	0.00%				0.00%	0.00%	0.01%
R111-4,3 Composite .05M Cit.	0.02%	0.04%	0.05%	0.05%	0.05%	0.08%	0.10%	0.12%	0.12%	0.05%	0.68%
R124 Composite Dist. H2O	0.00%	0.01%	0.01%	0.00%	0.00%				0.00%	0.00%	0.02%
R124 Composite .05M EDTA	0.05%	0.06%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.51%
R124-2 Composite Dist. H2O	0.03%	0.02%	0.01%	0.01%	0.02%				0.01%	0.01%	0.11%
R124-2 Composite .05M Cit	0.04%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.06%	0.06%	0.05%	0.51%
R124-3 Composite Dist. H2O	0.01%	0.00%	0.00%	0.00%	0.00%				0.00%	0.00%	0.01%
R124-3 Composite .05M Cit	0.01%	0.03%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	0.04%	0.43%
AVERAGE REMOVAL FOR DIST. H2O	0.03%										
AVERAGE REMOVAL FOR CITRIC ACID	0.39%										
AVERAGE REMOVAL FOR EDTA	0.51%										

% Pb Removed by Columnar Flooding

Sample	Pore #1	Pore #2	Pore #3	Pore #4	Pore #5	Pore #6	Pore #7	Pore #8	Drainage	Composite	TOTAL % REMOVED
Aberdeen Dist. H2O 5000 ppm Pb(NO3)2	0.00%	0.02%	0.01%	0.02%	0.02%				0.00%	0.01%	0.08%
Aberdeen .01M EDTA 5000 ppm Pb(NO3)2	0.09%	0.75%	0.65%	0.48%	0.38%	0.27%	0.29%	0.27%	0.08%	0.52%	3.78%
Ft. Mead Dist. H2O 5000 ppm Pb(NO3)2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			0.01%	0.00%	0.01%
Ft. Mead .01M EDTA 5000 ppm Pb(NO3)2	0.57%	2.53%	3.90%	0.34%	2.03%	1.53%	0.13%	1.05%	0.89%	0.17%	13.14%
LAAFB Dist. H2O 5000 ppm Pb(NO3)2	0.01%	0.00%	0.00%	0.00%	0.00%				0.00%	0.01%	0.02%
LAAFB .05M EDTA 5000 ppm Pb(NO3)2	1.74%	1.85%	1.93%	2.56%	2.88%	2.51%	2.39%	1.89%	1.64%	2.36%	21.75%
LAAFB-2 Dist. H2O 10000 ppm Pb(NO3)2	0.00%	0.00%	0.00%	0.00%	0.00%				0.00%	0.00%	0.00%
LAAFB-2 .05M EDTA 10000 ppm Pb(NO3)2	0.57%	0.87%	1.02%	0.93%	0.92%	1.24%	1.25%	1.04%	1.29%	0.78%	9.91%
LAAFB-3 Dist. H2O 10000 ppm Pb(NO3)2	0.01%	0.01%	0.01%	0.00%	0.00%				0.01%	0.01%	0.05%
LAAFB-3 .05M CIT. 10000 ppm Pb(NO3)2	0.36%	0.59%	0.71%	0.96%	0.81%	0.71%	0.56%	0.54%	0.38%	0.50%	6.12%
R111 Composite Dist. H2O	0.21%	0.27%	0.09%	0.09%	0.09%				0.26%	0.15%	1.16%
R111 Composite .05M EDTA	0.12%	0.61%	1.86%	2.40%	1.86%	1.33%	1.04%	0.92%	1.14%	1.42%	12.70%
R111-2 Composite Dist. H2O	0.16%	0.06%	0.08%	0.15%	0.03%				0.03%	0.04%	0.55%
R111-2 Composite .05M Cit.	0.12%	0.20%	0.14%	0.19%	0.19%	0.23%	0.16%	0.15%	0.38%	0.22%	1.98%
R111-3 Composite Dist. H2O	0.10%	0.13%	0.10%	0.17%	0.22%				0.13%	0.10%	0.95%
R111-3 Composite .05M Cit.	0.25%	0.09%	0.21%	0.39%	0.69%	0.31%	0.86%		0.73%	0.63%	4.16%
R111-4 Composite Dist. H2O	0.09%	0.07%	0.07%	0.07%	0.07%				0.07%	0.07%	0.51%
R111-4 Composite .05M Cit.	0.22%	0.37%	0.21%	0.44%	0.56%	0.30%	0.55%	0.39%	0.27%	0.34%	3.65%
R111-4,3 Composite Dist. H2O	0.07%	0.07%	0.07%	0.07%	0.07%				0.07%	0.07%	0.49%
R111-4,3 Composite .05M Cit.	0.18%	0.21%	0.54%	0.80%	0.88%	0.75%	4.25%	0.93%	0.76%	0.67%	9.97%
R122 Composite Dist. H2O	0.09%	0.08%	0.03%	0.03%	0.03%				0.09%	0.05%	0.40%
R122 Composite .05M EDTA	0.11%	2.86%	12.01%	10.96%	6.63%	4.52%	3.08%	2.45%	1.88%	6.07%	50.57%
R124 Composite Dist. H2O	0.01%	0.01%	0.01%	0.00%	0.00%				0.01%	0.01%	0.05%
R124 Composite .05M EDTA	1.56%	1.67%	1.55%	1.63%	1.02%	0.88%	0.70%	0.62%	0.63%	1.14%	11.40%
R124-2 Composite Dist. H2O	0.03%	0.02%	0.01%	0.01%	0.01%				0.01%	0.01%	0.10%
R124-2 Composite .05M Cit	0.07%	0.19%	0.22%	0.24%	0.24%	0.22%	0.31%	0.29%	0.23%	0.29%	2.30%
R124-3 Composite Dist. H2O	0.00%	0.00%	0.00%	0.00%	0.00%				0.00%	0.00%	0.00%
R124-3 Composite .05M Cit	0.01%	0.11%	0.21%	0.20%	0.19%	0.18%	0.17%	0.17%	0.14%	0.16%	1.54%
AVERAGE REMOVAL FOR DIST. H2O	0.31%										
AVERAGE REMOVAL FOR CITRIC ACID	4.25%										
AVERAGE REMOVAL FOR EDTA	17.61%										

% Zn Removed by Columnar Flooding

Sample	Pore #1	Pore #2	Pore #3	Pore #4	Pore #5	Pore #6	Pore #7	Pore #8	Drainage	Composite	TOTAL % REMOVED
R111-2 Composite Dist. H2O	0.08%	0.07%	0.07%	0.07%	0.06%				0.07%	0.06%	0.48%
R111-2 Composite .05M Cit.	0.35%	0.08%	0.10%	0.11%	0.09%	0.08%	0.07%	0.06%	0.12%	0.10%	1.16%
R111-3 Composite Dist. H2O	0.12%	0.15%	0.07%	0.10%	0.04%				0.10%	0.06%	0.64%
R111-3 Composite .05M Cit.	0.11%	1.07%	0.44%	0.47%	0.42%	0.31%	0.18%		0.51%	0.35%	3.86%
R111-4 Composite Dist. H2O	0.11%	0.14%	0.10%	0.05%	0.09%				0.07%	0.11%	0.67%
R111-4 Composite .05M Cit.	0.66%	0.14%	0.14%	0.12%	0.74%	0.68%	0.66%	0.65%	0.72%	1.14%	5.65%
R111-4,3 Composite Dist. H2O	0.33%	0.22%	0.23%	0.20%	0.09%				0.24%	0.16%	1.47%
R111-4,3 Composite .05M Cit.	0.23%	1.76%	3.78%	2.37%	2.02%	1.92%	1.98%	1.96%	1.81%	1.90%	19.73%
R124 Composite Dist. H2O	0.17%	0.11%	0.26%	0.13%	0.15%				0.21%	0.23%	1.26%
R124 Composite .05M EDTA	0.50%	0.63%	0.55%	0.43%	0.41%	0.48%	0.51%	0.41%	0.45%	0.50%	4.87%
R124-2 Composite Dist. H2O	1.23%	0.37%	0.42%	0.33%	0.51%				0.27%	0.36%	3.49%
R124-2 Composite .05M Cit	0.77%	0.86%	0.99%	0.61%	0.94%	0.82%	0.59%	0.76%	2.22%	0.62%	9.18%
R124-3 Composite Dist. H2O	0.49%	0.34%	0.38%	0.69%	0.62%				0.93%	0.35%	3.80%
R124-3 Composite .05M Cit	1.06%	3.28%	3.84%	2.48%	3.39%	1.40%	2.52%	2.13%	1.84%	2.01%	23.95%
AVERAGE REMOVAL FOR DIST. H2O	1.69%										
AVERAGE REMOVAL FOR CITRIC ACID	10.59%										
AVERAGE REMOVAL FOR EDTA	4.87%										