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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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**Energy Systems Division  
Argonne National Laboratory**



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# **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  $^{109}\text{Cd}$  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 Section<sup>1</sup> 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.

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<sup>1</sup> 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<sub>3</sub>) 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<br>Methods of Soil Analysis (Part 8) <sup>1</sup> |
| Particle Size Characterization:              |                                                            |
| Size Gradation-sieving                       | ASTM D2487-85 <sup>2</sup>                                 |
| Particle Size Analysis<br>(hydrometer)       | ASTM D422-63 <sup>2</sup>                                  |
| Particle Size Analysis                       | USCS <sup>3</sup>                                          |
| Soil pH                                      | EPA 9045<br>Methods of Soil Analysis (Part 9)              |
| Organic Carbon                               | Methods of Soil Analysis (Part 29)                         |
| Heavy Metals (Pb, Cd, Cu, Cr,<br>Zn, Ba, Fe) | Standard Methods                                           |

<sup>1</sup> American Society of Agronomy and Soil Science Society of America 1982.

<sup>2</sup> American Society for Testing Materials (1987a, 1987b).

<sup>3</sup> Particle size classification is in accordance with the Unified Soil Classification System.

TABLE 2 Physical and Chemical Characteristics of Soil Samples<sup>1</sup>

| Range<br>(R)     | Depth<br>(cm) | Soil<br>pH | Organic<br>Carbon<br>(%) | CEC<br>(gmol/kg) | Soil Texture (g/kg) |      |      | Textural<br>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   |                   |

<sup>1</sup> 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- $\mu\text{m}$  sieve (American Society for Testing Materials [ASTM] mesh #20) and retained by a 75- $\mu\text{m}$  sieve (ASTM mesh #200). Soil that passed through the 75- $\mu\text{m}$  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  $\text{HNO}_3$ ) 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, Germany<sup>1</sup>

| Contaminant                   | Concentration                    |                              |
|-------------------------------|----------------------------------|------------------------------|
|                               | Industrial Water<br>Well No. 118 | Drinking Water<br>Well No. 6 |
| Organics (mg/L):              |                                  |                              |
| Dichloromethane               | ND <sup>2</sup>                  | 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 <sub>4</sub> -N) | 0.1                              | 20                           |



TABLE 3 (Cont.)

| Contaminant                                   | Concentration                    |                              |
|-----------------------------------------------|----------------------------------|------------------------------|
|                                               | Industrial Water<br>Well No. 118 | Drinking Water<br>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 <sub>5</sub> <sup>3</sup>                 | 1.8                              | 5.0                          |
| KMnO <sub>4</sub> Demand <sup>4</sup>         | 1.1                              | 37                           |
| Total Suspended Solids                        | 6                                | 11                           |
| Total Dissolved Solids                        | 25                               | 740                          |
| Residue                                       | 5                                | 445                          |
| Buffer Capacity (mmol/L)                      | 0.15                             | 2.9                          |

<sup>1</sup> Adapted from Dames & Moore International 1992.

<sup>2</sup> ND = Not Detected.

<sup>3</sup> BOD<sub>5</sub> = Biological Oxygen Demand.

<sup>4</sup> KMnO<sub>4</sub> = 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<br>(mg/kg) |               |               | Concentration in Groundwater<br>(mg/L) |               |               |
|---------------|----------------------------------|---------------|---------------|----------------------------------------|---------------|---------------|
|               | Category<br>A                    | Category<br>B | Category<br>C | Category<br>A                          | Category<br>B | Category<br>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 ( $\sim 0$ ) 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<br>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                                 | <b>7,870</b>          | 1.2          | 271           | 7.5   | 51.8  | 77.6         |
| -S004                                      | <b>126,000</b>        | <u>7.6</u>   | <b>798</b>    | 5.6   | 37.   | 125          |
| -S007                                      | <b>4,800</b>          | 0.97         | <b>6,420</b>  | 7.2   | 57.3  | 700          |
| -S009                                      | <b>13,600</b>         | 2.1          | <b>13,200</b> | 10.1  | 53.7  | <u>1,350</u> |
| -S014                                      | <b>1,800</b>          | 0.98         | 29.9          | 6.6   | 28.9  | 105          |
| -S015                                      | <b>684</b>            | 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                   | <b>31.1</b>  | <u>276</u>    | 34.8  | 97.3  | <b>5,680</b> |
| -S038                                      | <u>152</u>            | <b>32.3</b>  | <u>370</u>    | 41.8  | 115   | <u>691</u>   |
| -S039                                      | 90.6                  | <b>94.6</b>  | <b>1,560</b>  | 27.7  | 94.8  | <u>976</u>   |
| -S041                                      | 70.1                  | <b>32.5</b>  | <u>364</u>    | 44.4  | 164   | <u>703</u>   |
| -S044                                      | 70.7                  | <b>73.6</b>  | <u>322</u>    | 25.8  | 92.0  | 48.6         |
| -S049                                      | 26.0                  | 1.0          | 11.0          | 16.3  | 61.0  | --           |
| Dutch List Standards<br>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<br>mg/L <sup>2</sup> | Soil               |                    | TCLP<br>mg/L <sup>2</sup> |
|            | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           |
| 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                      |
| <hr/>      |                    |                    |                           |                    |                    |                           |
| 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<br>mg/L <sup>2</sup> | Soil               |                    | TCLP<br>mg/L <sup>2</sup> |
|            | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           |
| 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                      |

<sup>1</sup> Determined by the Argonne ACL using ICP-AES.

<sup>2</sup> 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<br>mg/L <sup>2</sup> | Soil               |                    | TCLP<br>mg/L <sup>2</sup> |
|            | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           |
| 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                      |
| <hr/>      |                    |                    |                           |                    |                    |                           |
| 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<br>mg/L <sup>2</sup> | Soil               |                    | TCLP<br>mg/L <sup>2</sup> |
|            | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           |
| 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                      |

<sup>1</sup> Determined by the Argonne ACL using ICP-AES.

<sup>2</sup> 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<br>mg/L <sup>2</sup> | Soil               |                    | TCLP<br>mg/L <sup>2</sup> |
|            | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           |
| 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                      |
| <hr/>      |                    |                    |                           |                    |                    |                           |
| 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<br>mg/L <sup>2</sup> | Soil               |                    | TCLP<br>mg/L <sup>2</sup> |
|            | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           | mg/kg <sup>1</sup> | mg/kg <sup>2</sup> |                           |
| 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                      |

<sup>1</sup> Determined by the Argonne ACL using ICP-AES.

<sup>2</sup> 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<br>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.)

| Sample No.           | Element Concentration (mg/kg) |    |             |    |    |              |       |
|----------------------|-------------------------------|----|-------------|----|----|--------------|-------|
|                      | 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 | <u>46.32</u> | 1,560      | ~0 |
|            | 7.421 | 90.6       | 9.31  | 94.6 | <u>62.88</u> | 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 Standards

Underlined 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<br>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.)

| Sample No.           |       | pH   | Element Concentration (mg/kg) |         |              |            |           |         |
|----------------------|-------|------|-------------------------------|---------|--------------|------------|-----------|---------|
|                      |       |      | Cr                            |         | Ba           |            | Zn        |         |
|                      |       |      | 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     | <b>416.5</b> | <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    | <b>473.8</b> | 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.<sup>2</sup> 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

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

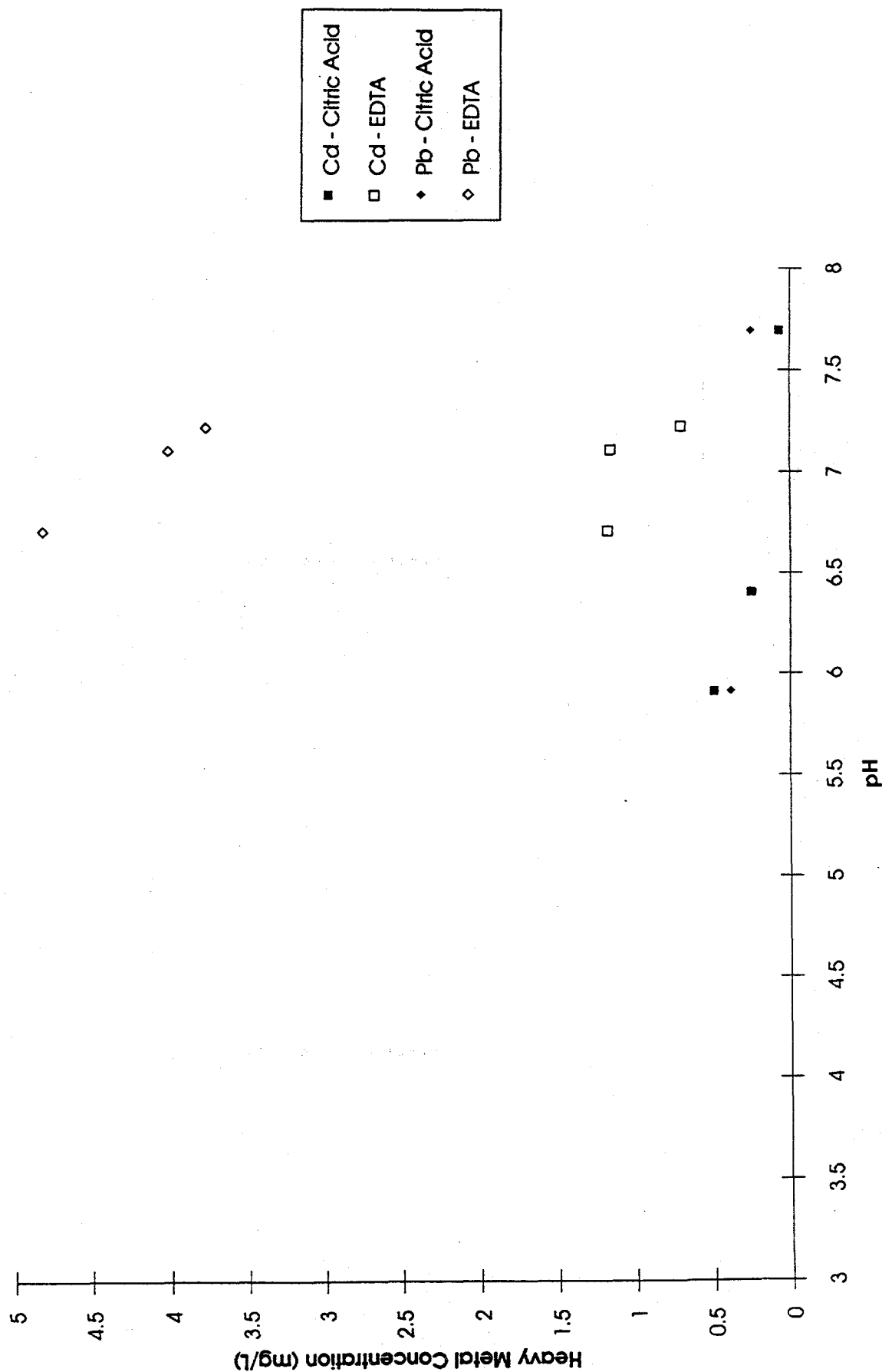


FIGURE 1 Solubilization of Heavy Metals (Cd and Pb) from Contaminated Soil Samples S037, S038, S039, S041, S044, and S049, Using 0.01M Citric Acid and 0.01M EDTA



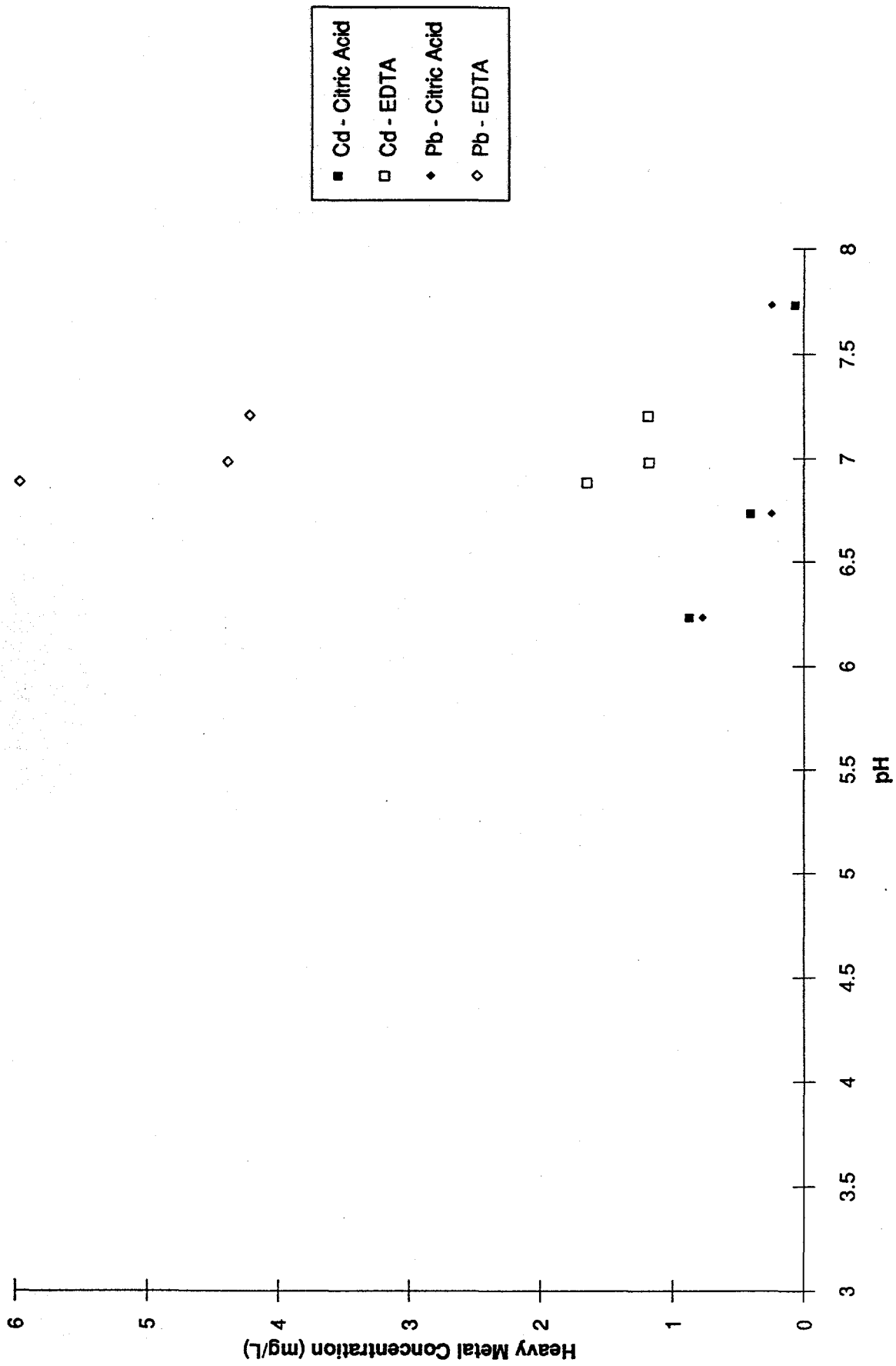


FIGURE 1 (Cont.)

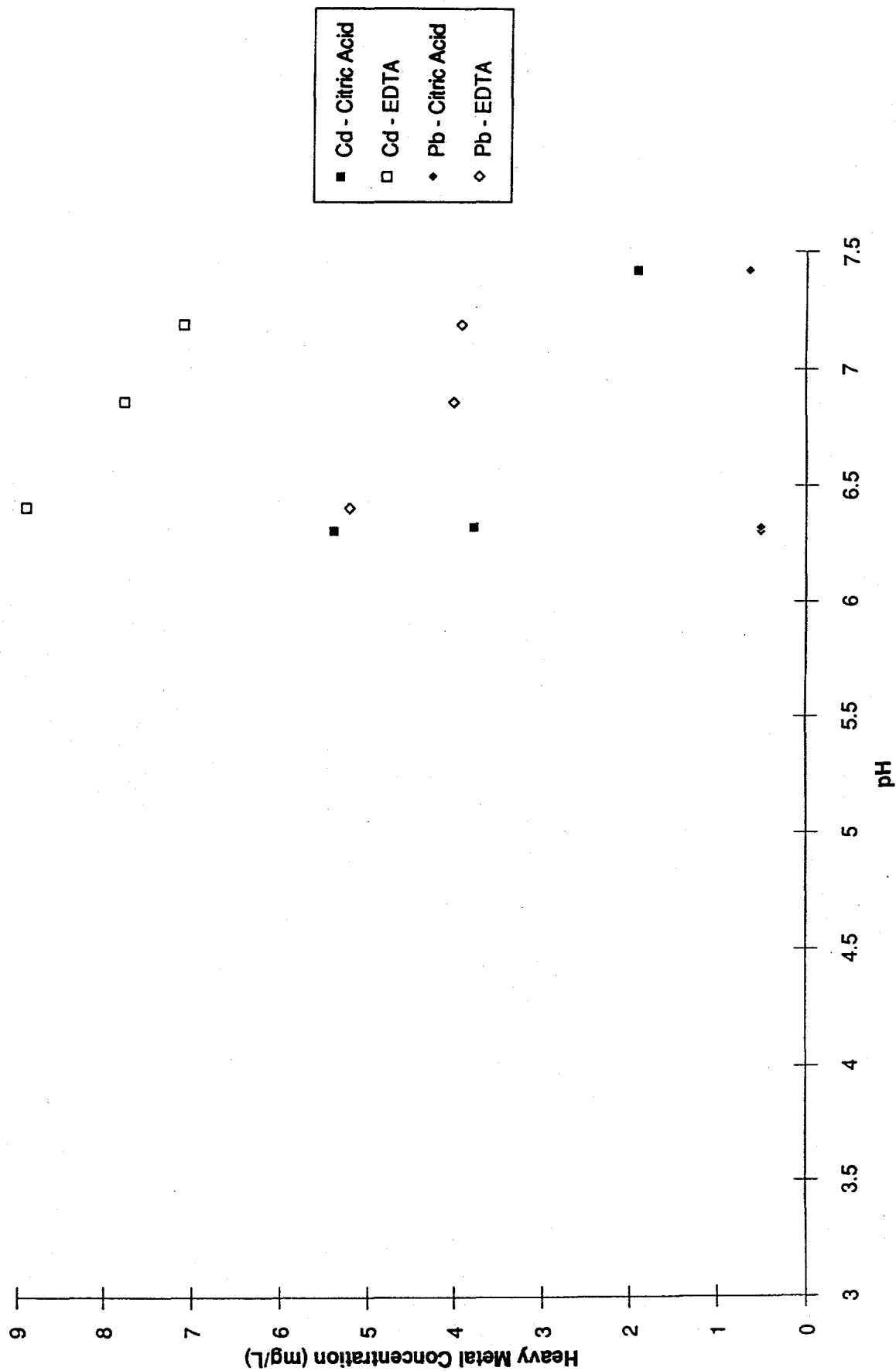


FIGURE 1 (Cont.)

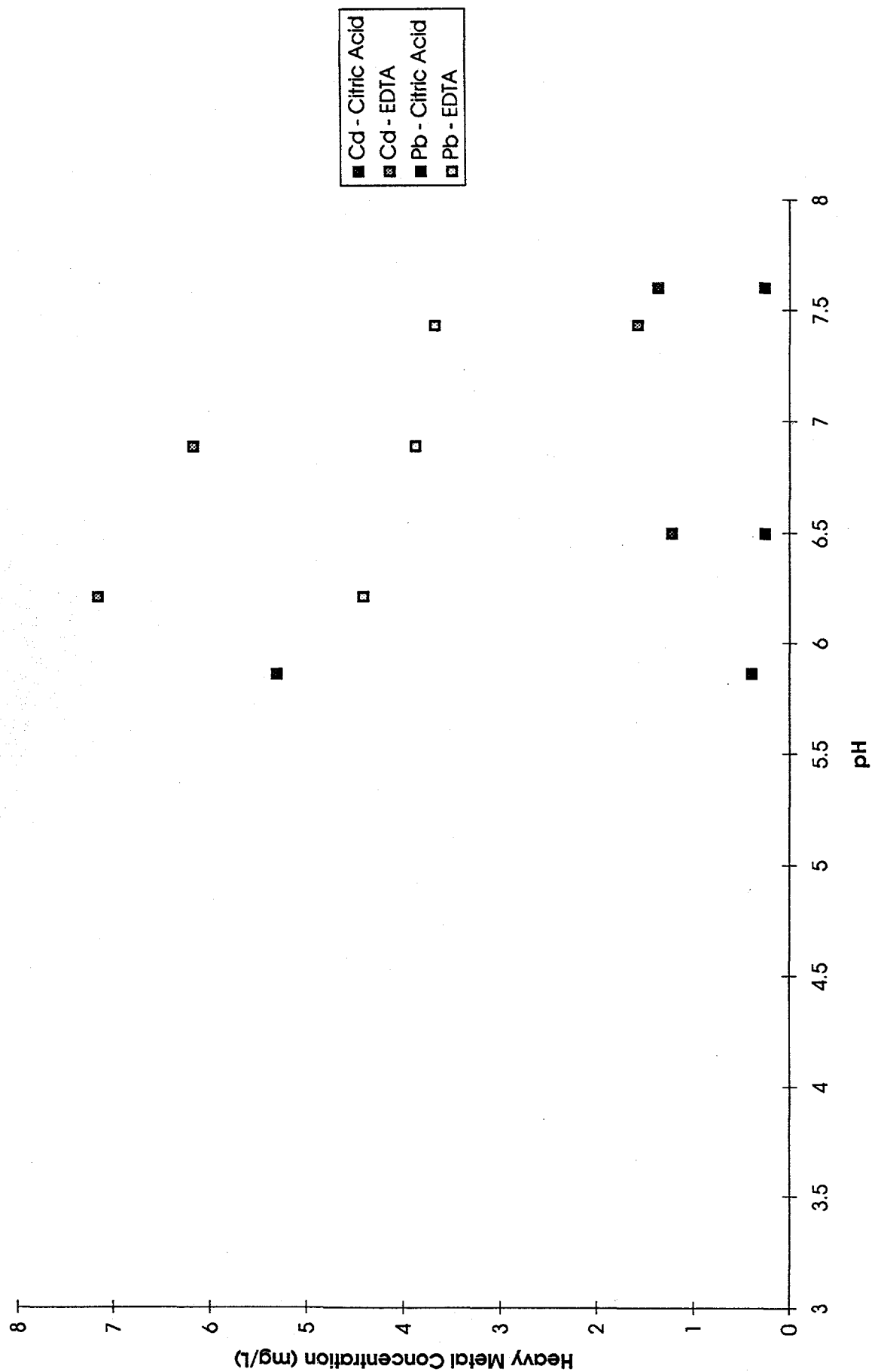


FIGURE 1 (Cont.)

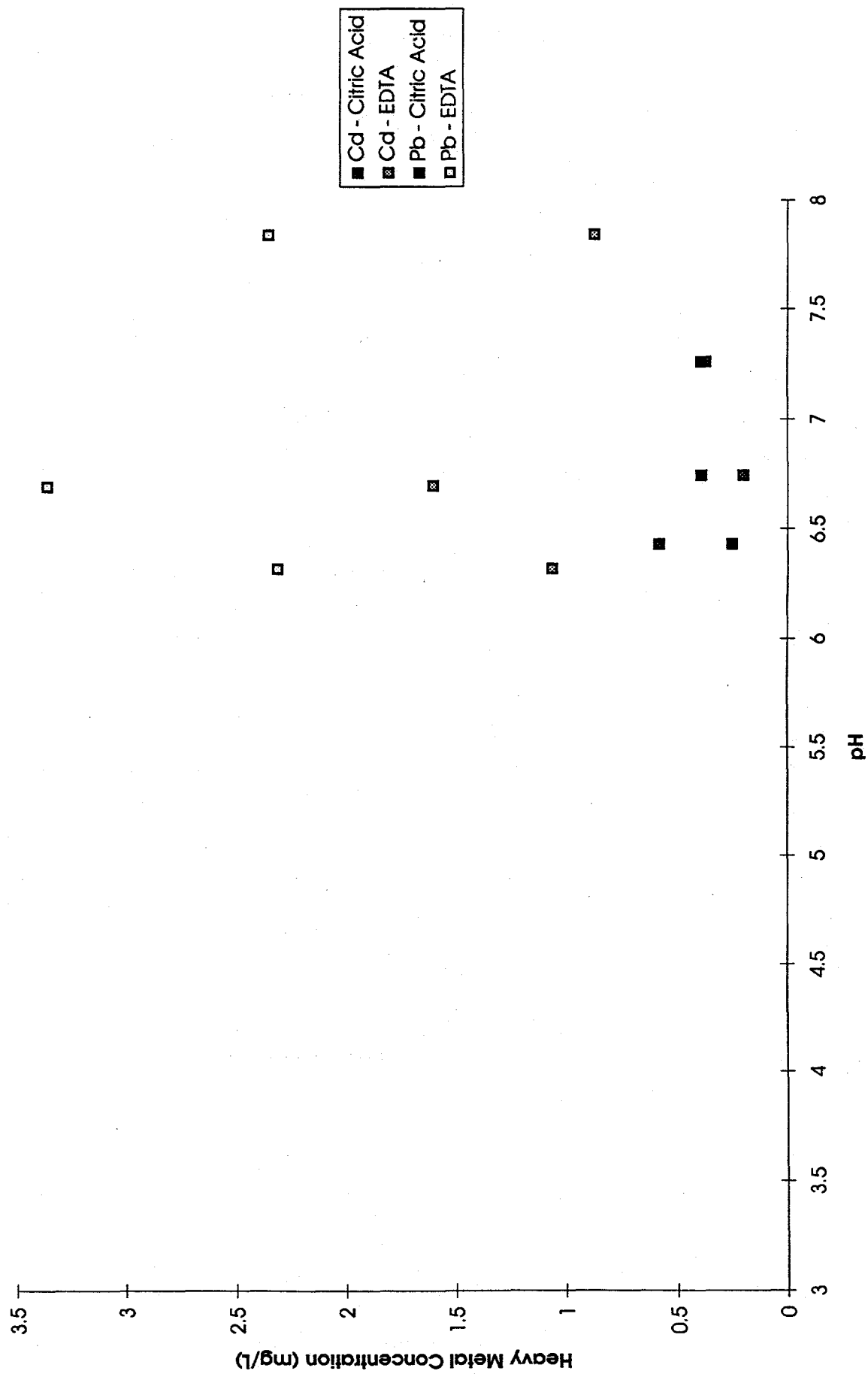


FIGURE 1 (Cont.)

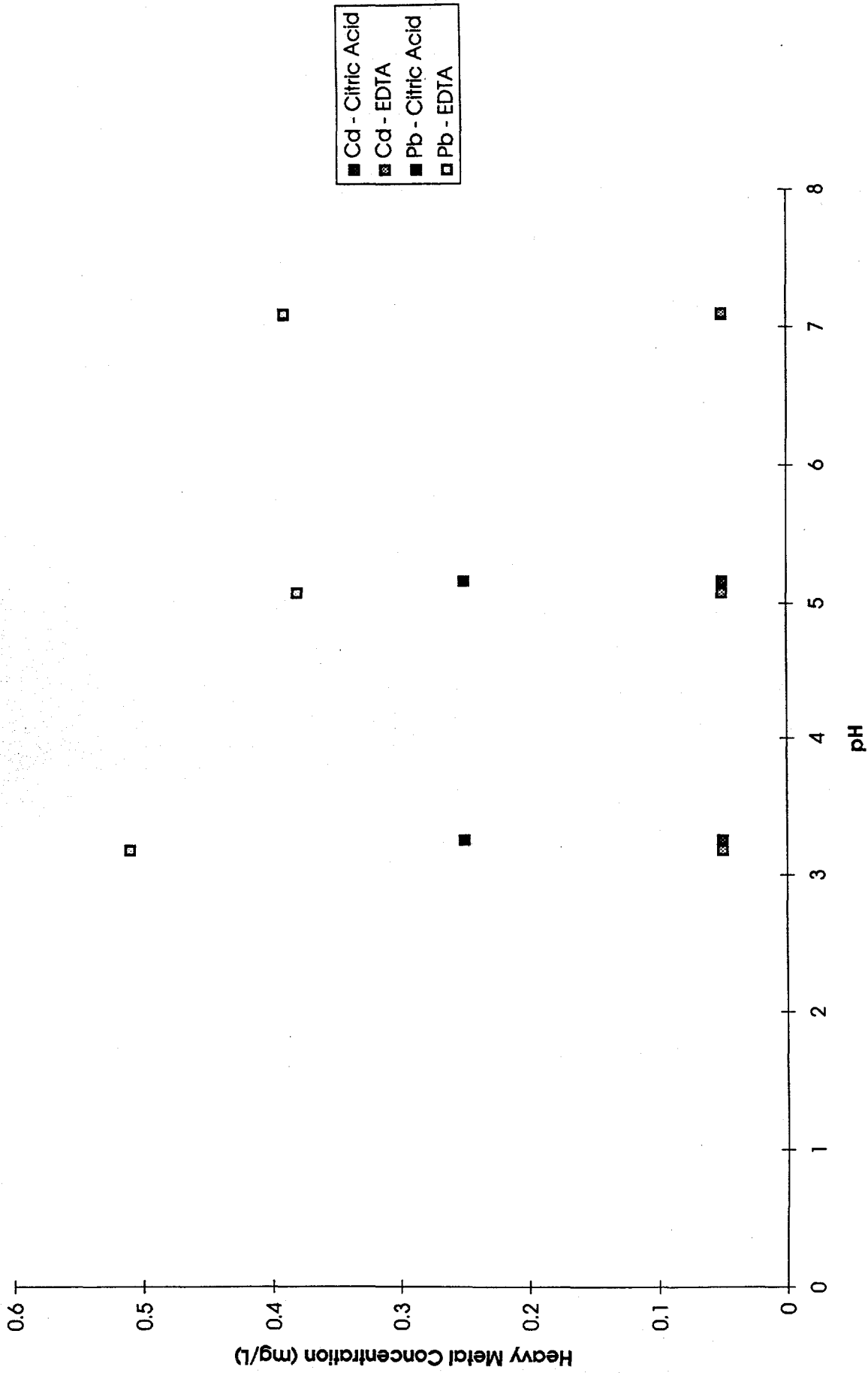


FIGURE 1 (Cont.)

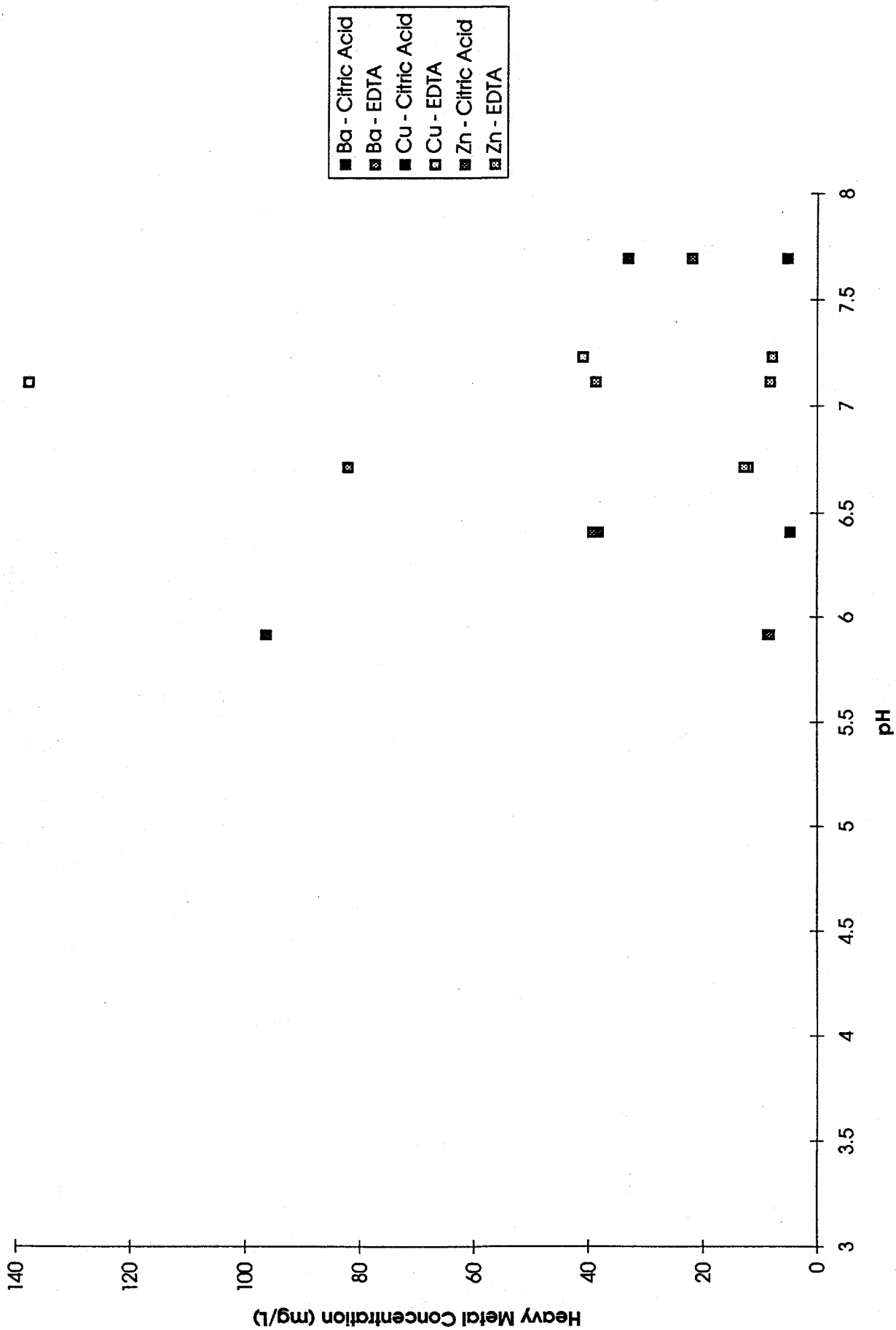


FIGURE 2 Solubilization of Heavy Metals (Ba, Cu, and Zn) from Contaminated Soil Samples S037, S038, S039, S041, S044, and S049, Using 0.01M Citric Acid and 0.01M EDTA

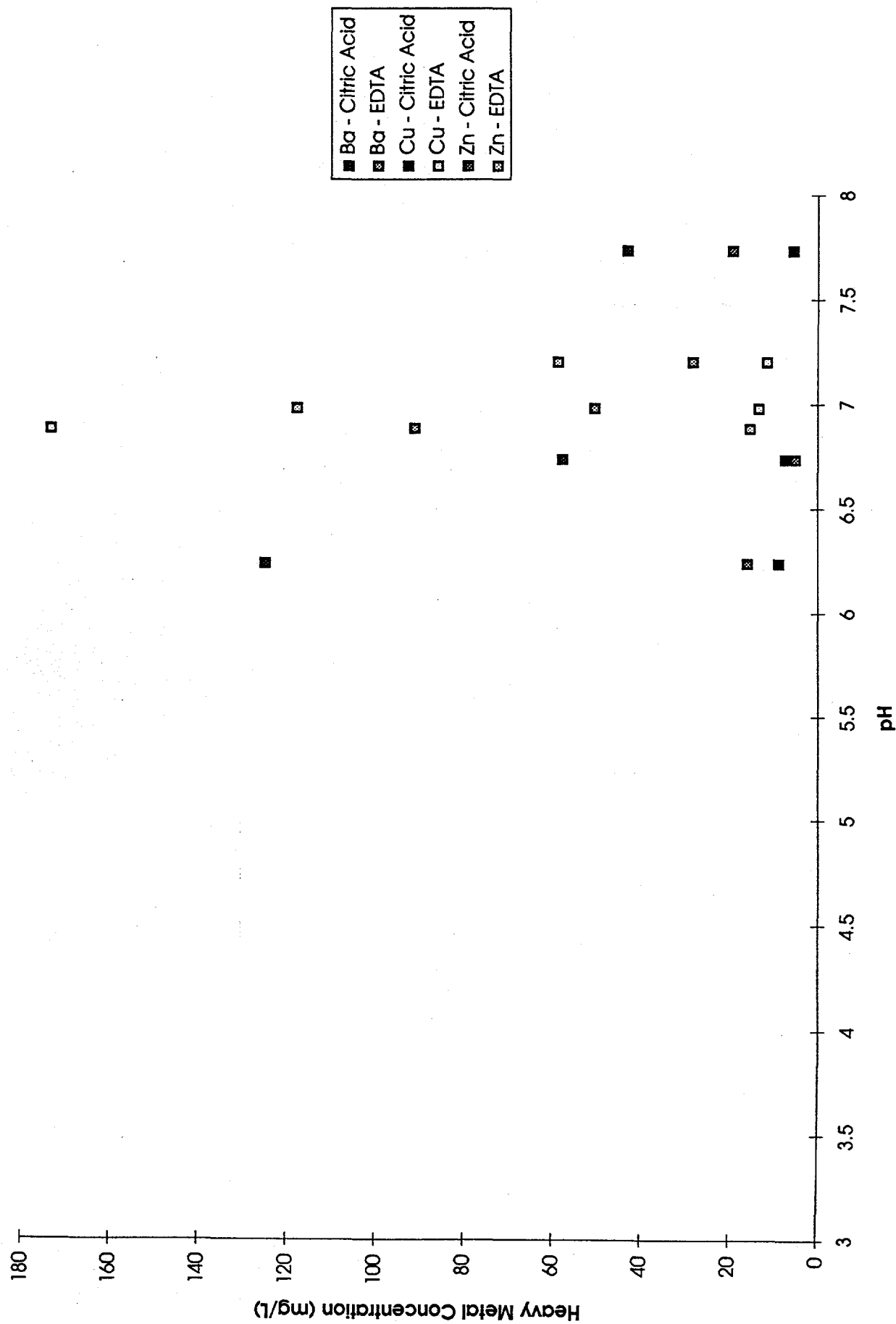


FIGURE 2 (Cont.)

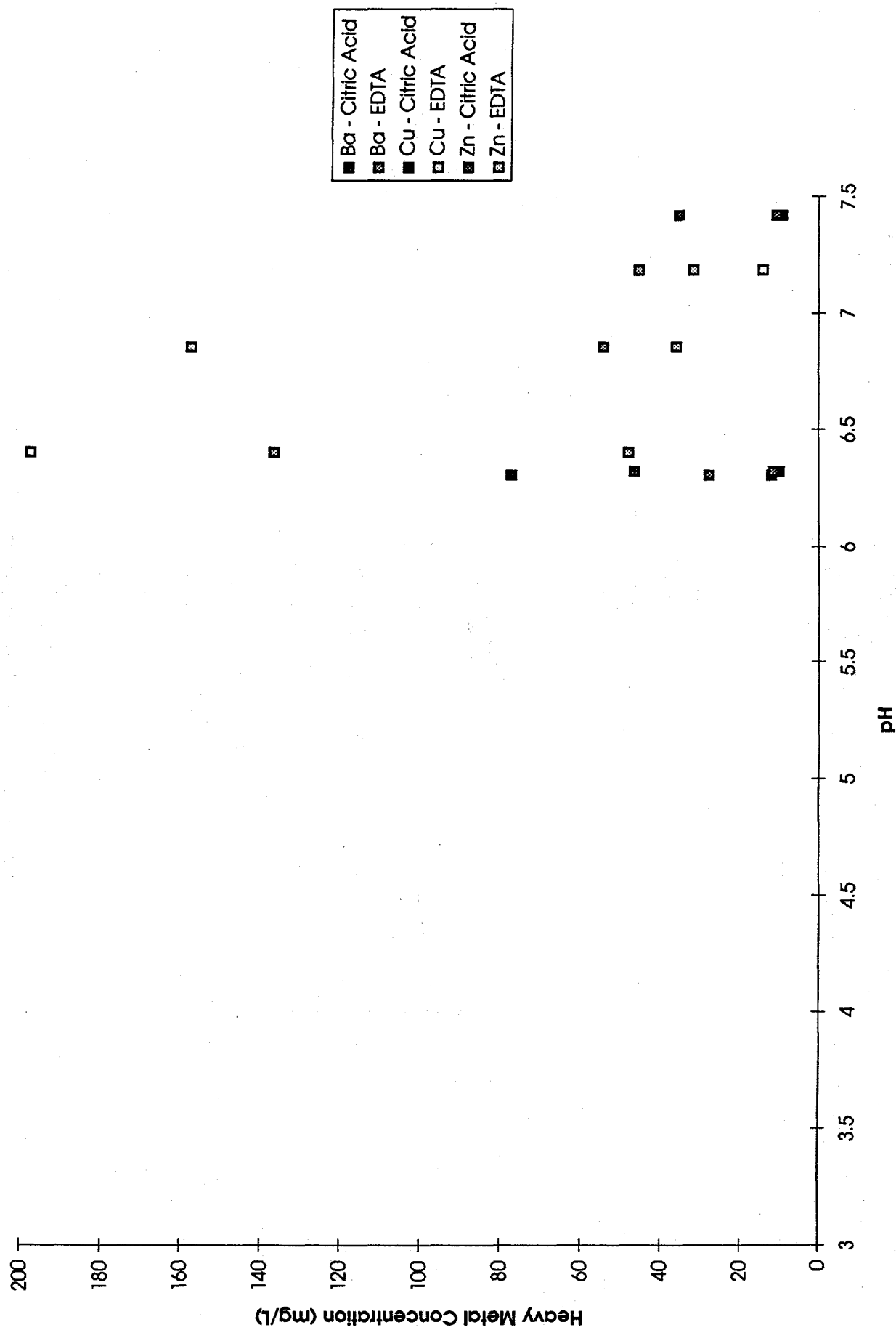


FIGURE 2 (Cont.)



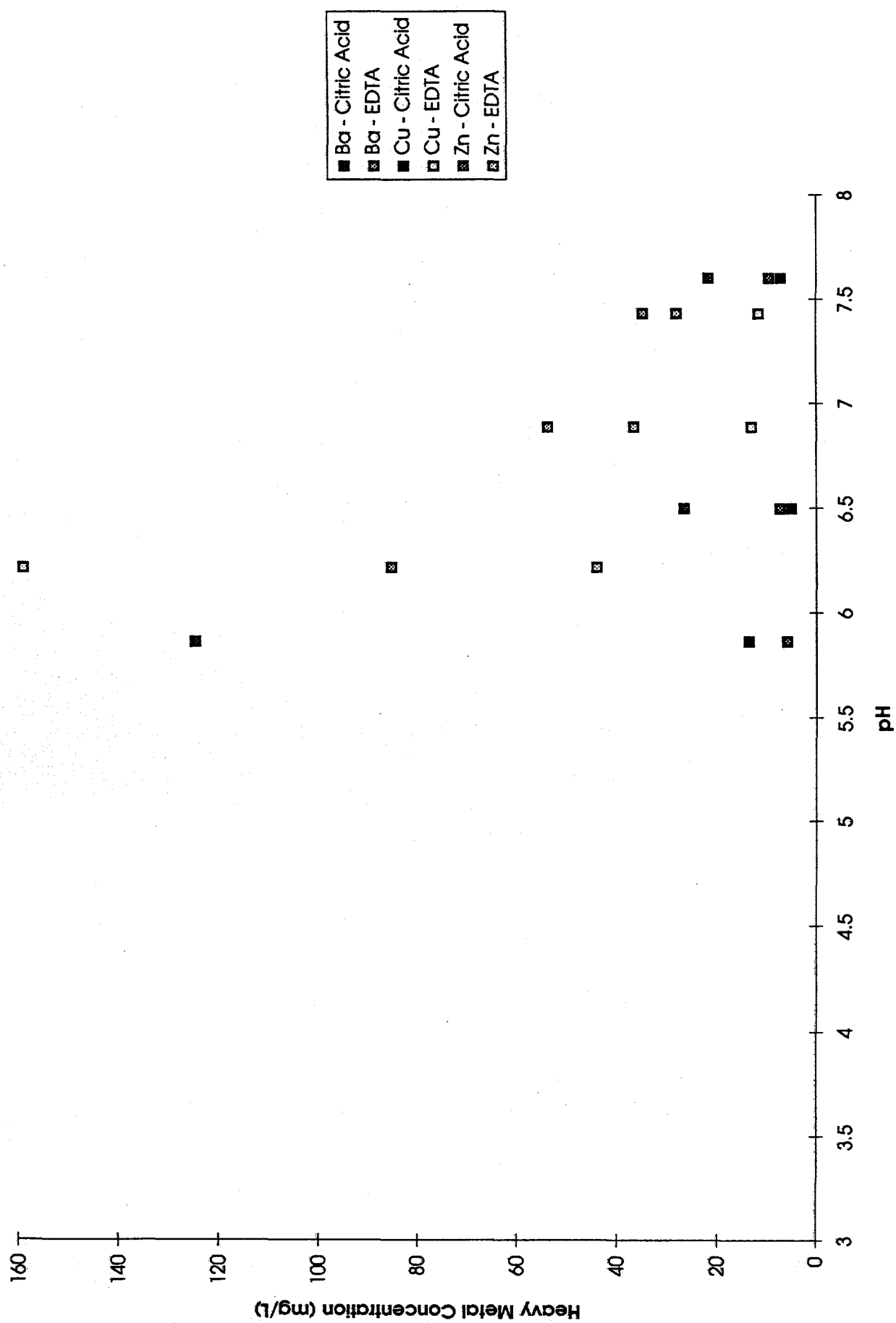


FIGURE 2 (Cont.)

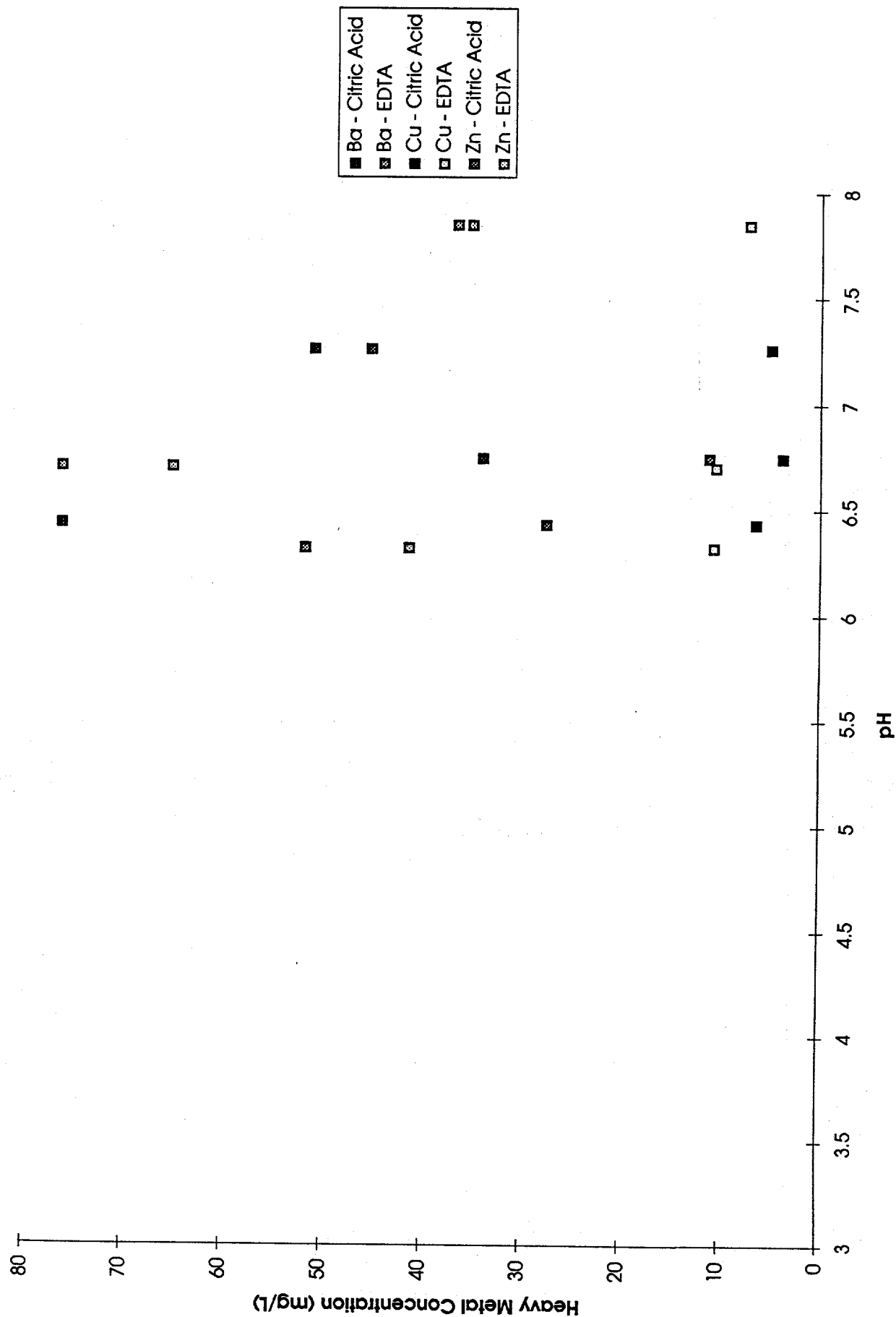


FIGURE 2 (Cont.)

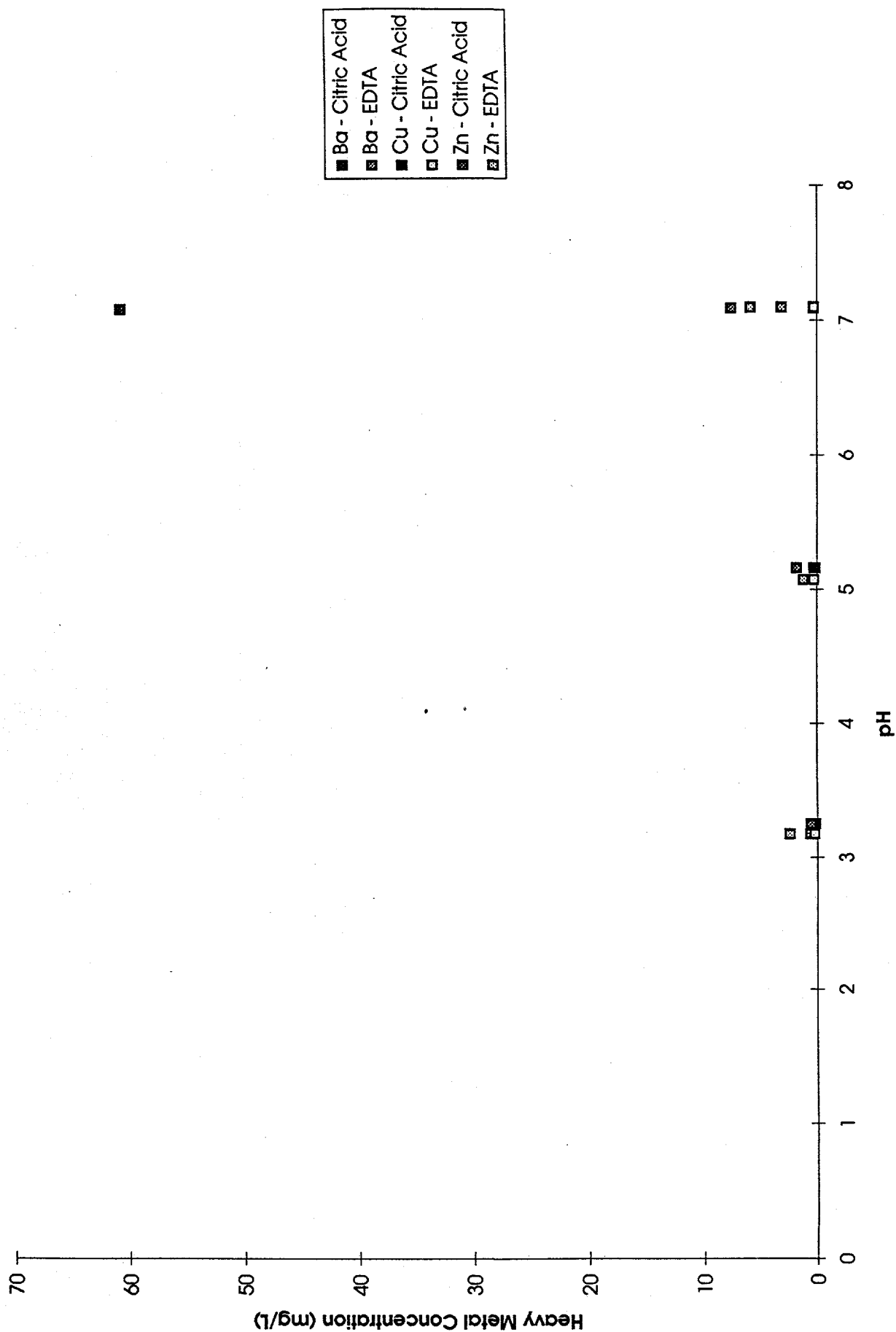


FIGURE 2 (Cont.)

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

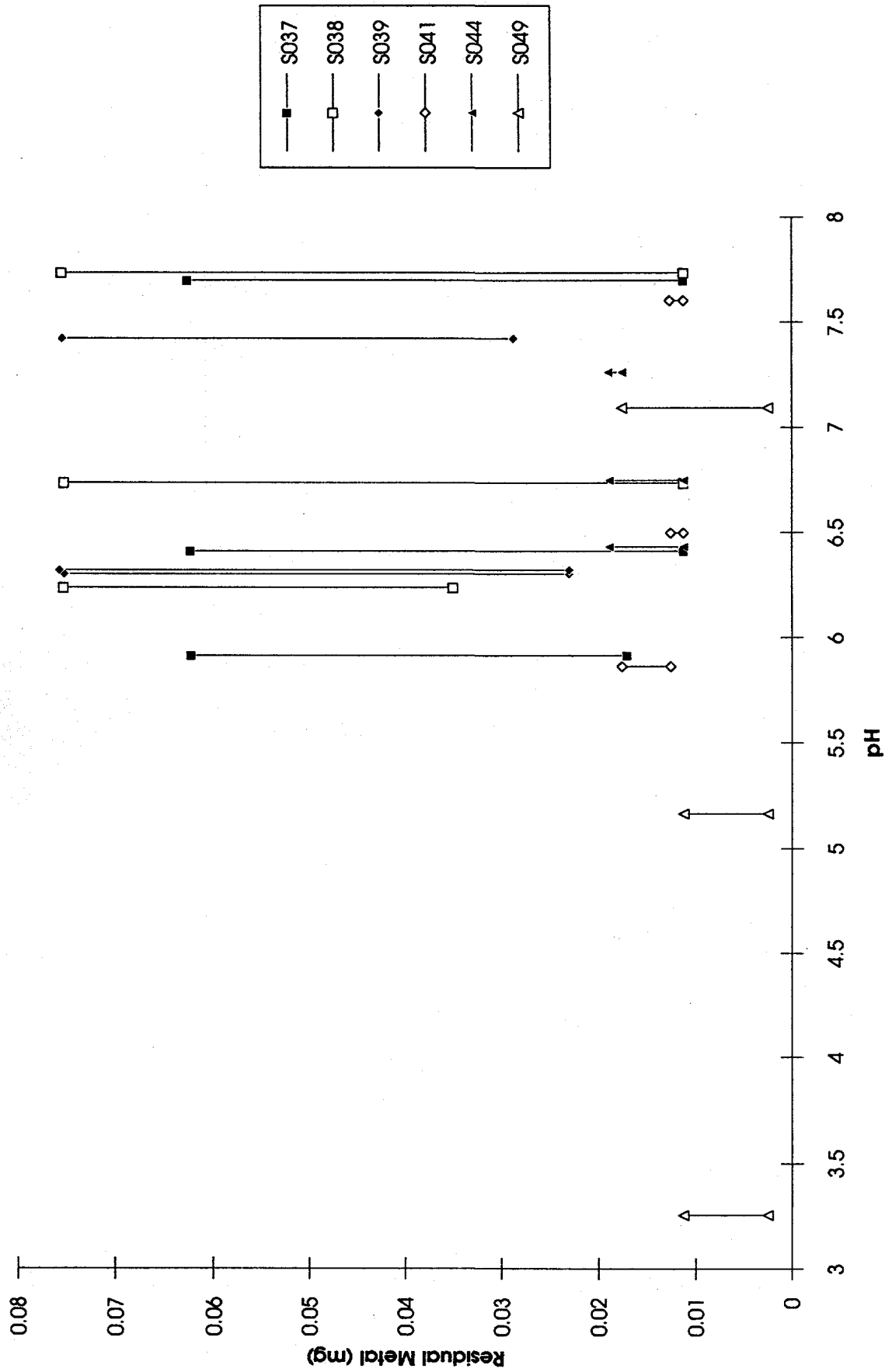


FIGURE 3. Initial and Final Heavy Metals Concentrations from Six Soil Samples as a Function of pH for Batch Chelant Extraction of Pb, Cd, Cr, Cu, Ba, and Zn, Using 0.01M Citric Acid

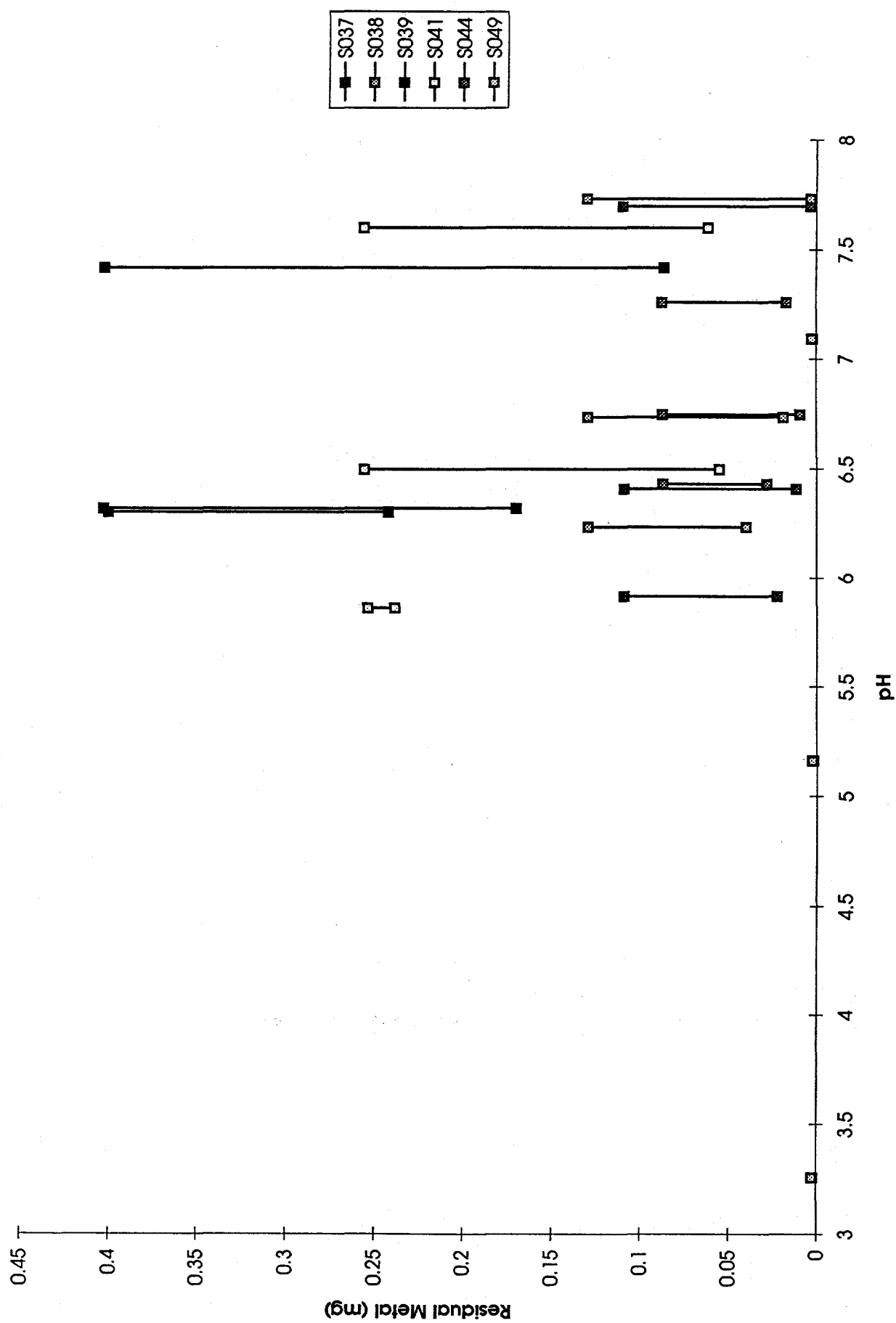


FIGURE 3 (Cont.)

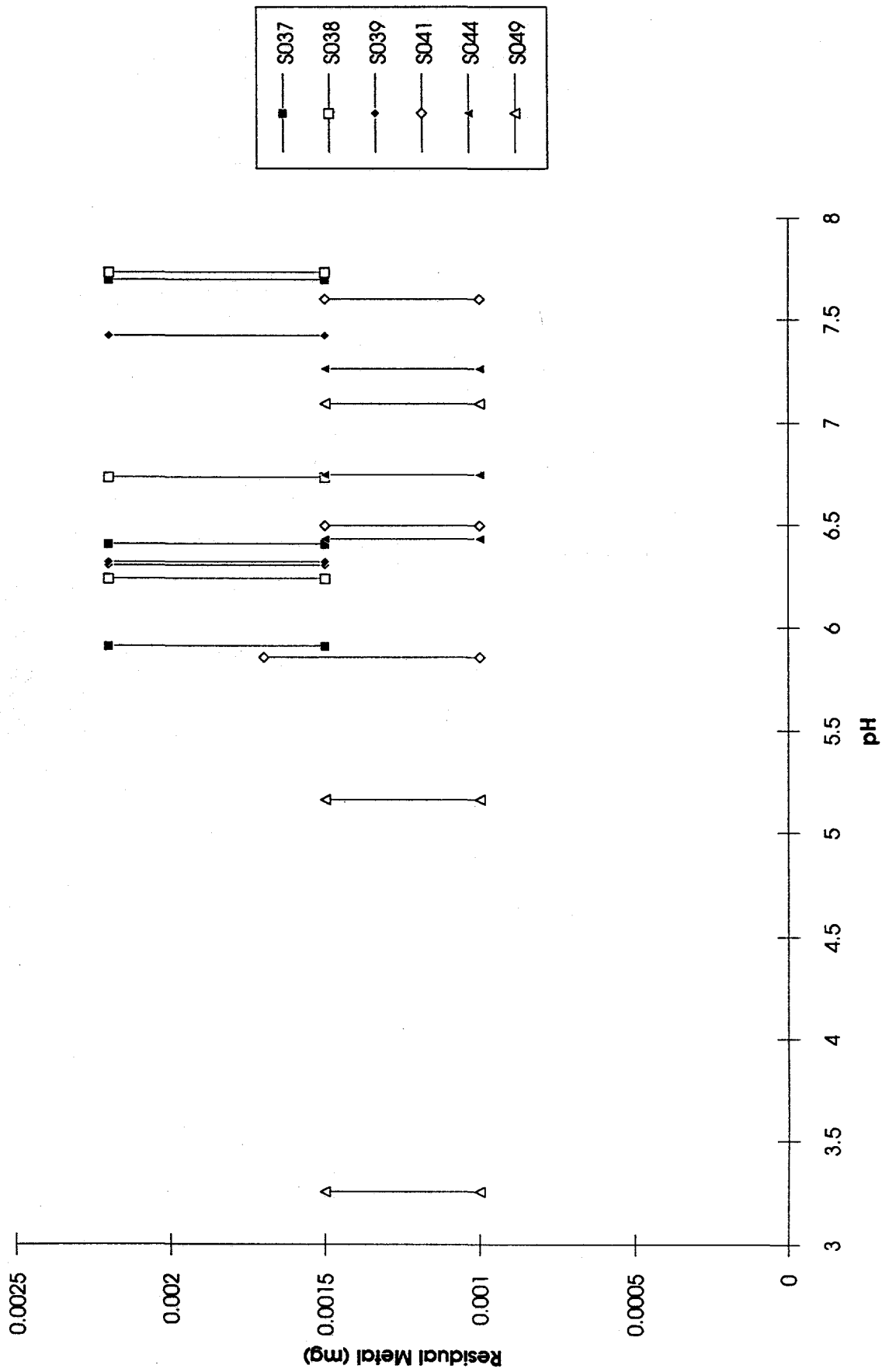


FIGURE 3 (Cont.)

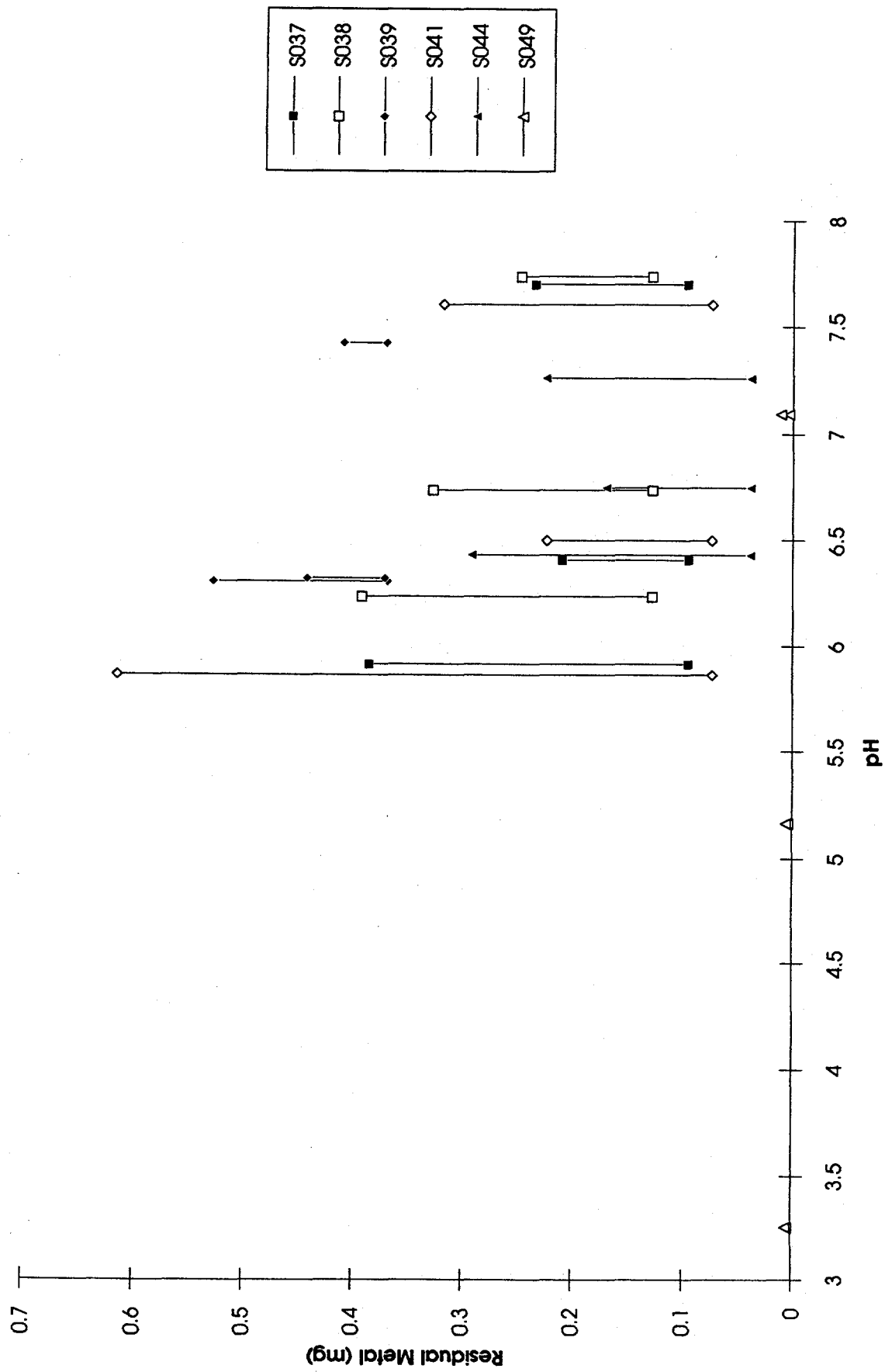


FIGURE 3 (Cont.)



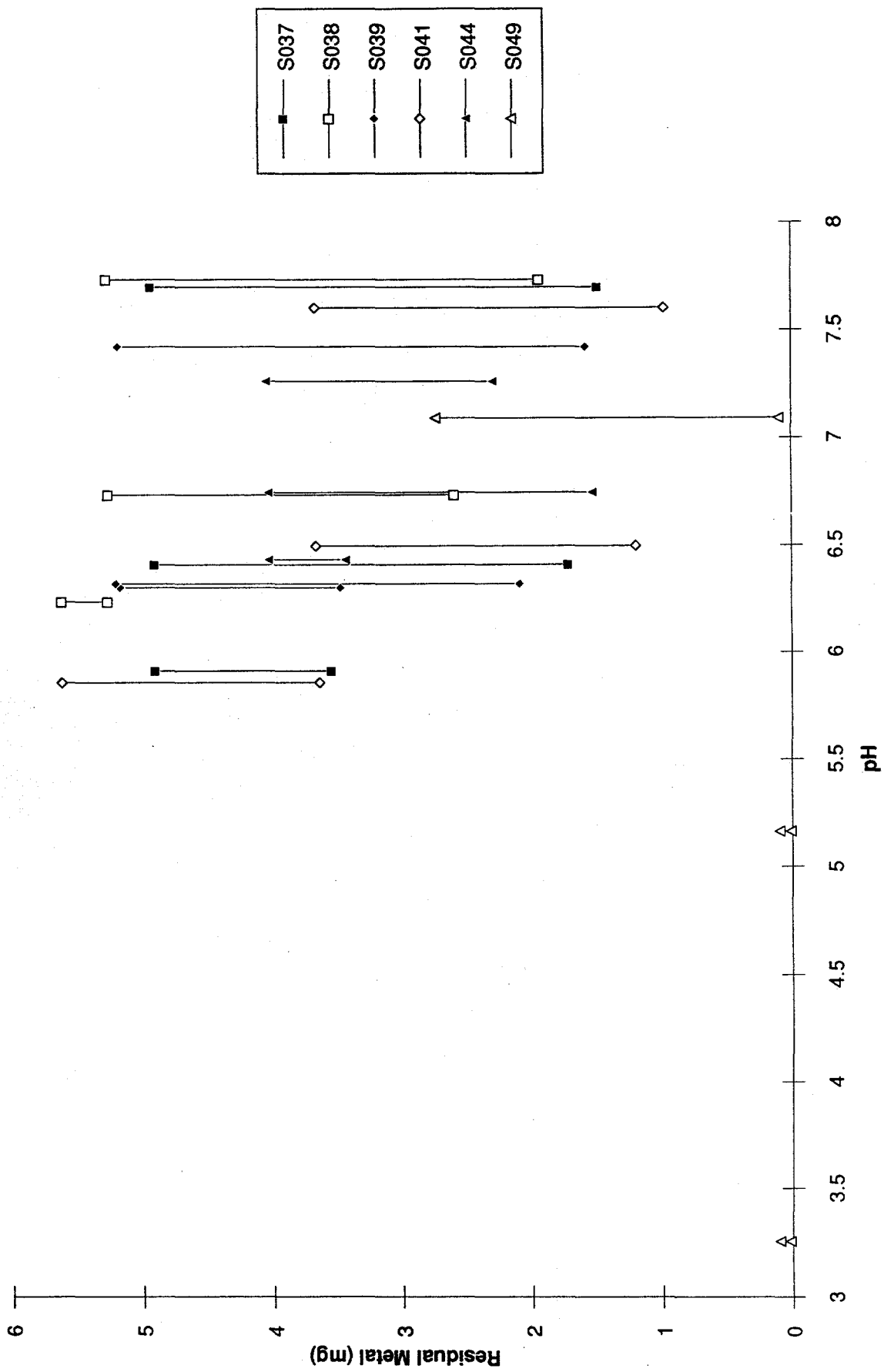


FIGURE 3 (Cont.)

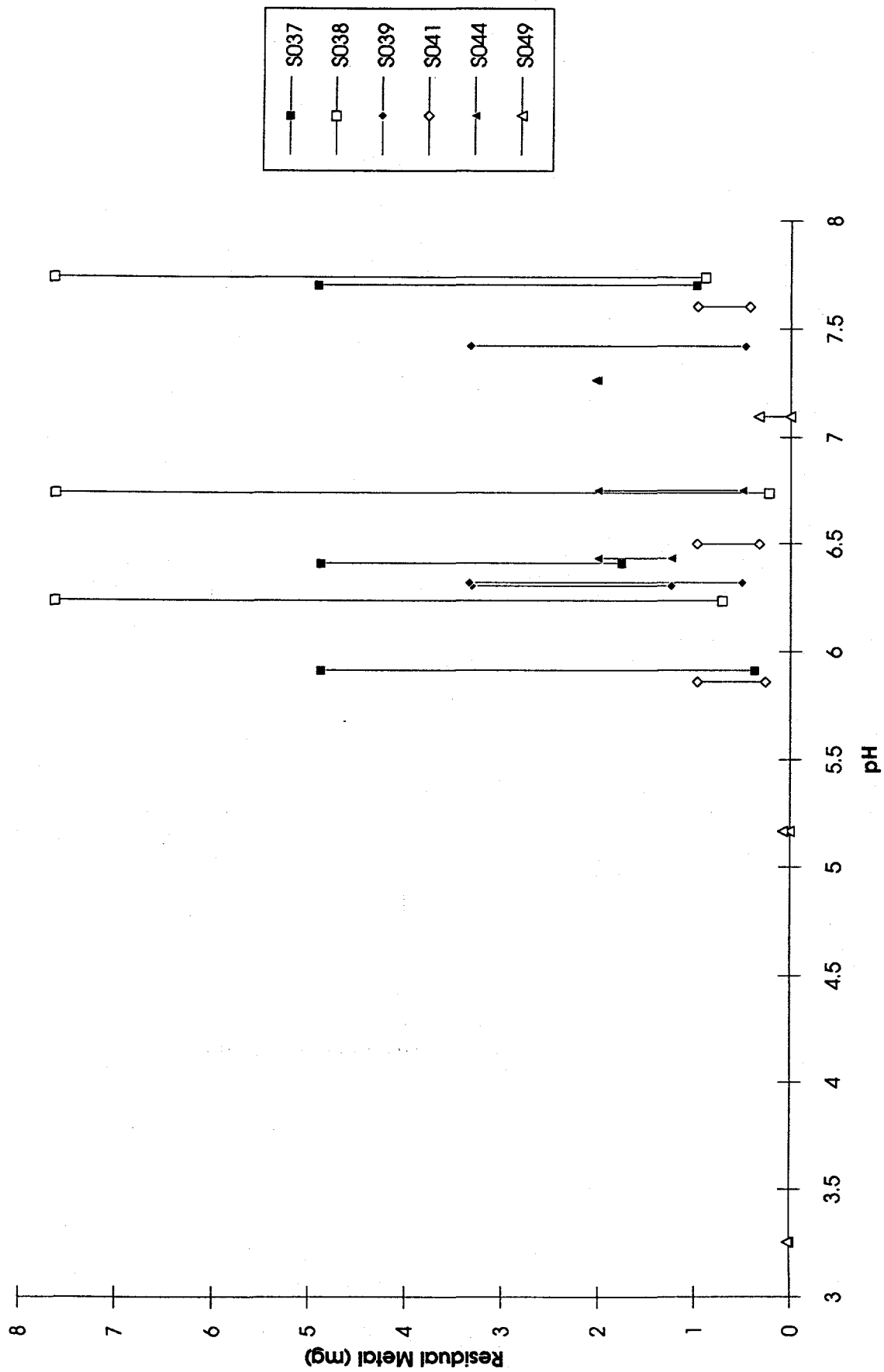


FIGURE 3 (Cont.)

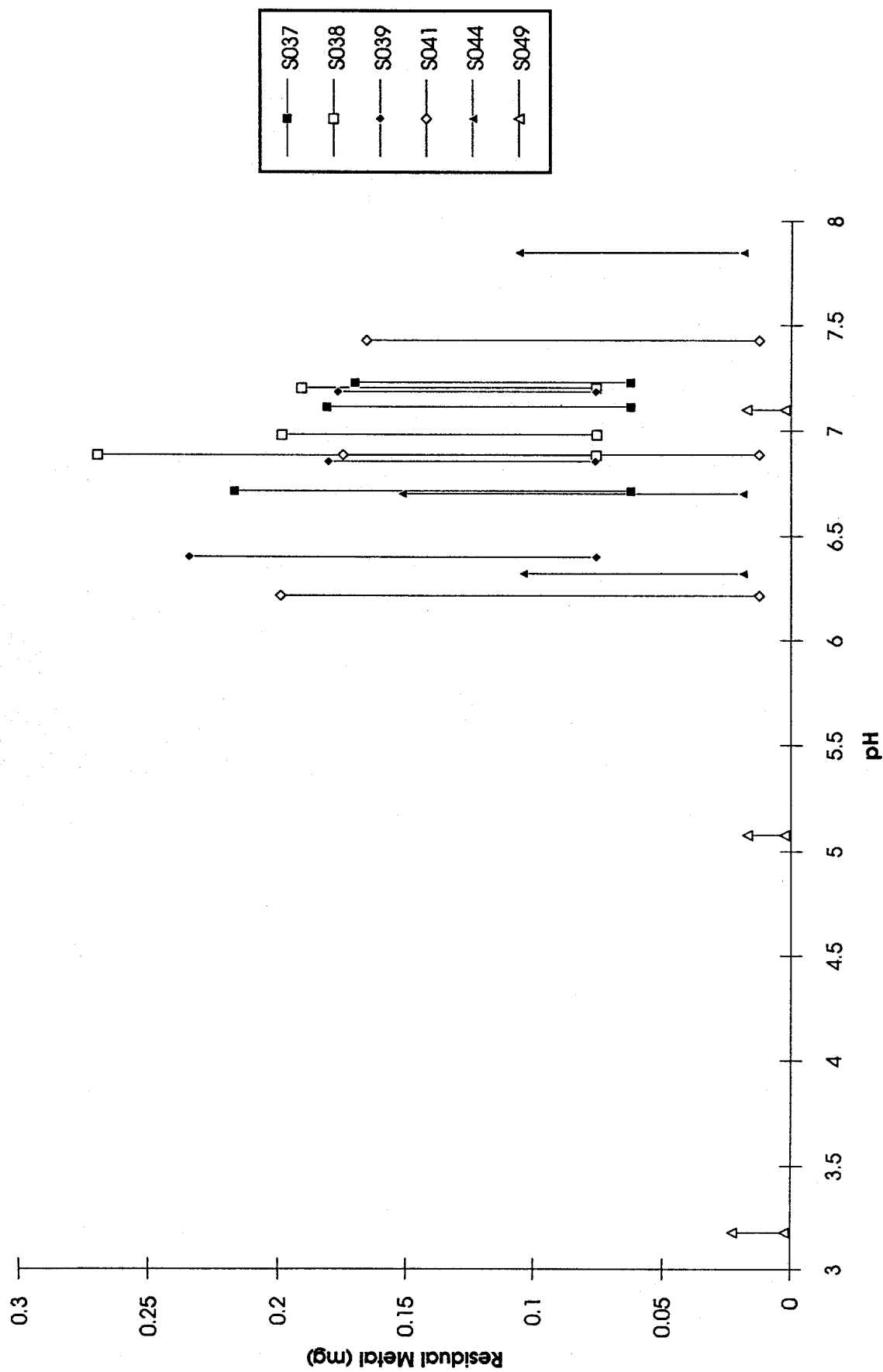


FIGURE 4 Initial and Final Heavy Metals Concentrations from Six Soil Samples as a Function of pH for Batch Chelant Extraction of Pb, Cd, Cr, Cu, Ba, and Zn, Using 0.01M EDTA

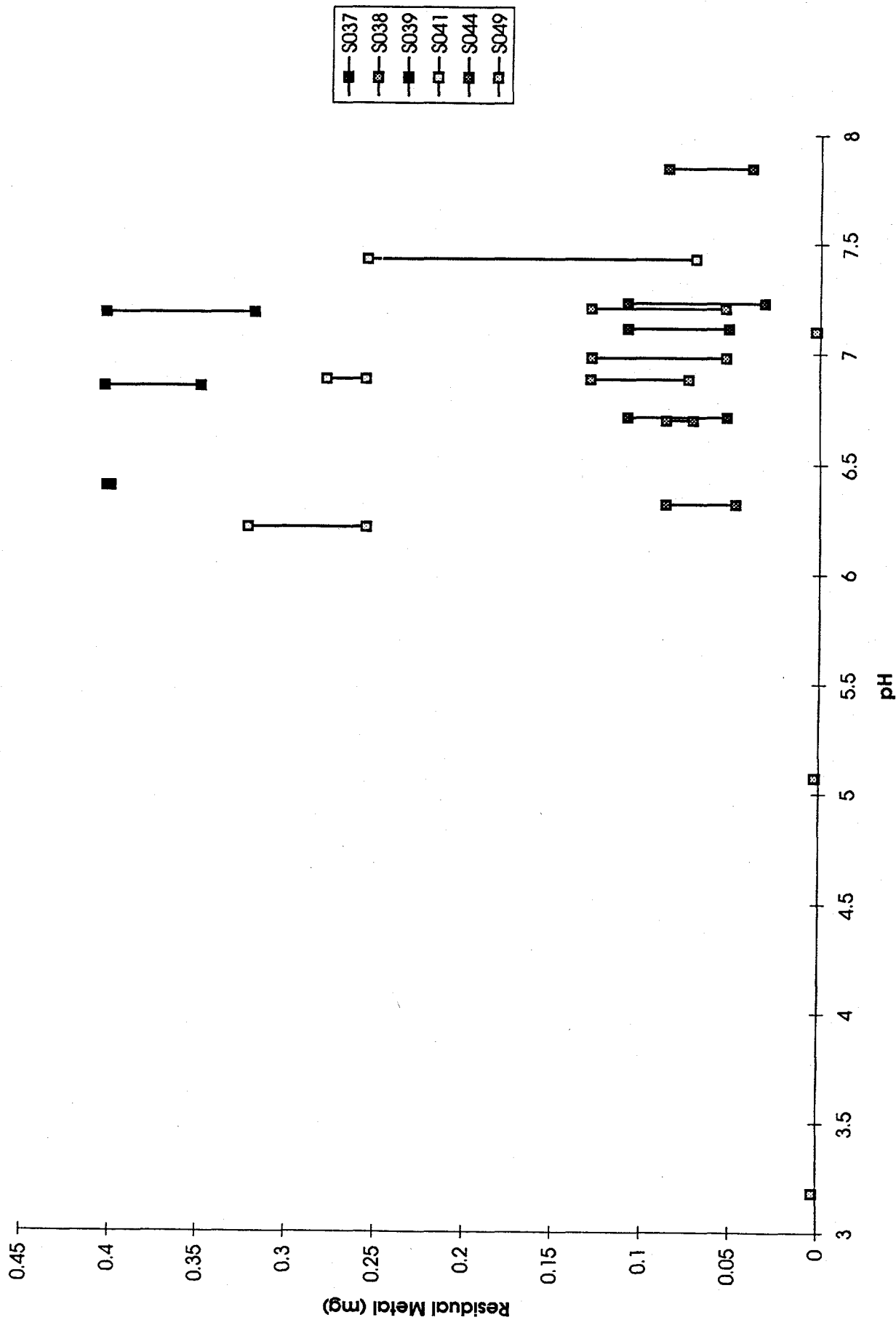


FIGURE 4 (Cont.)

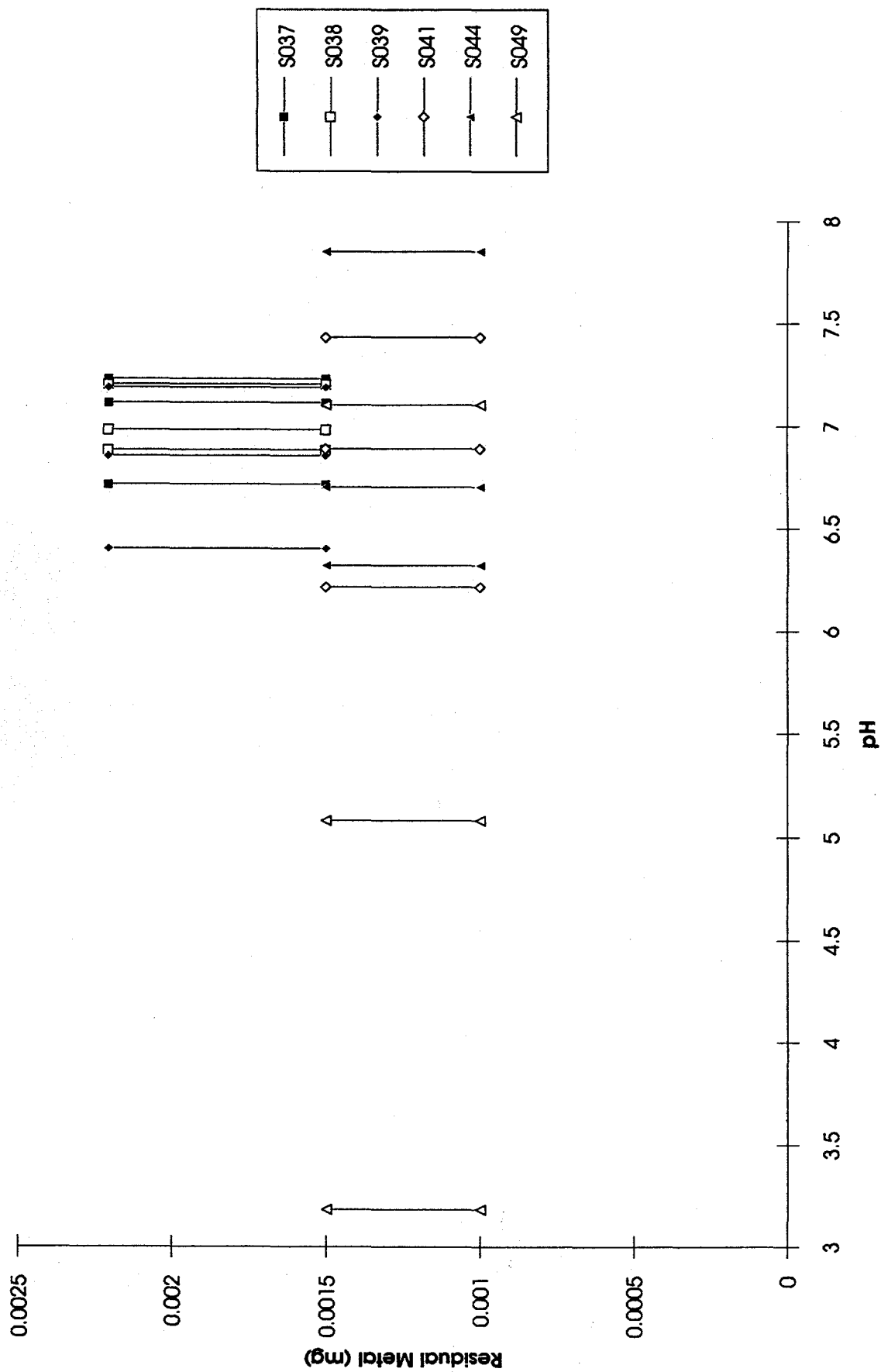


FIGURE 4 (Cont.)

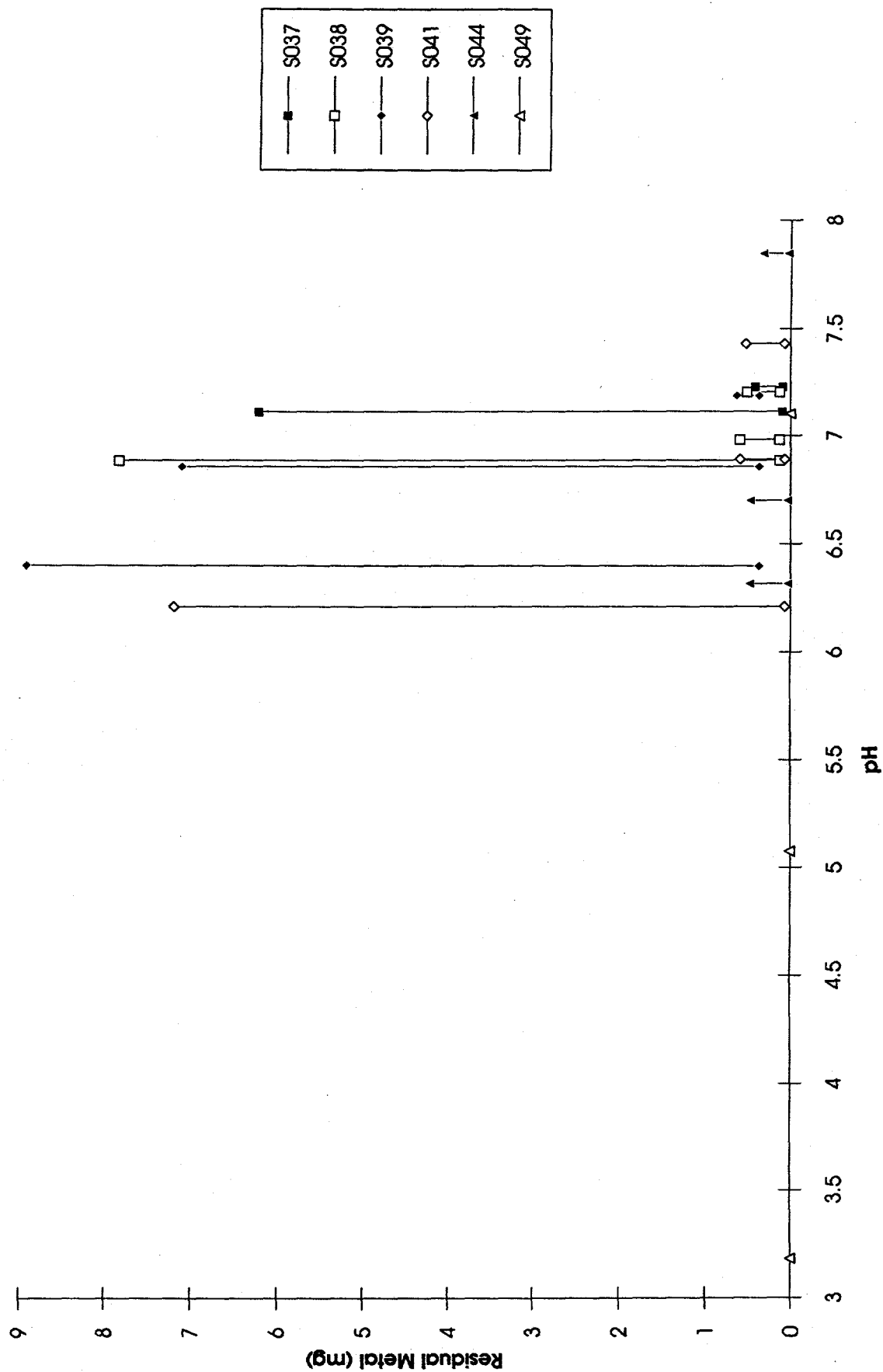


FIGURE 4 (Cont.)

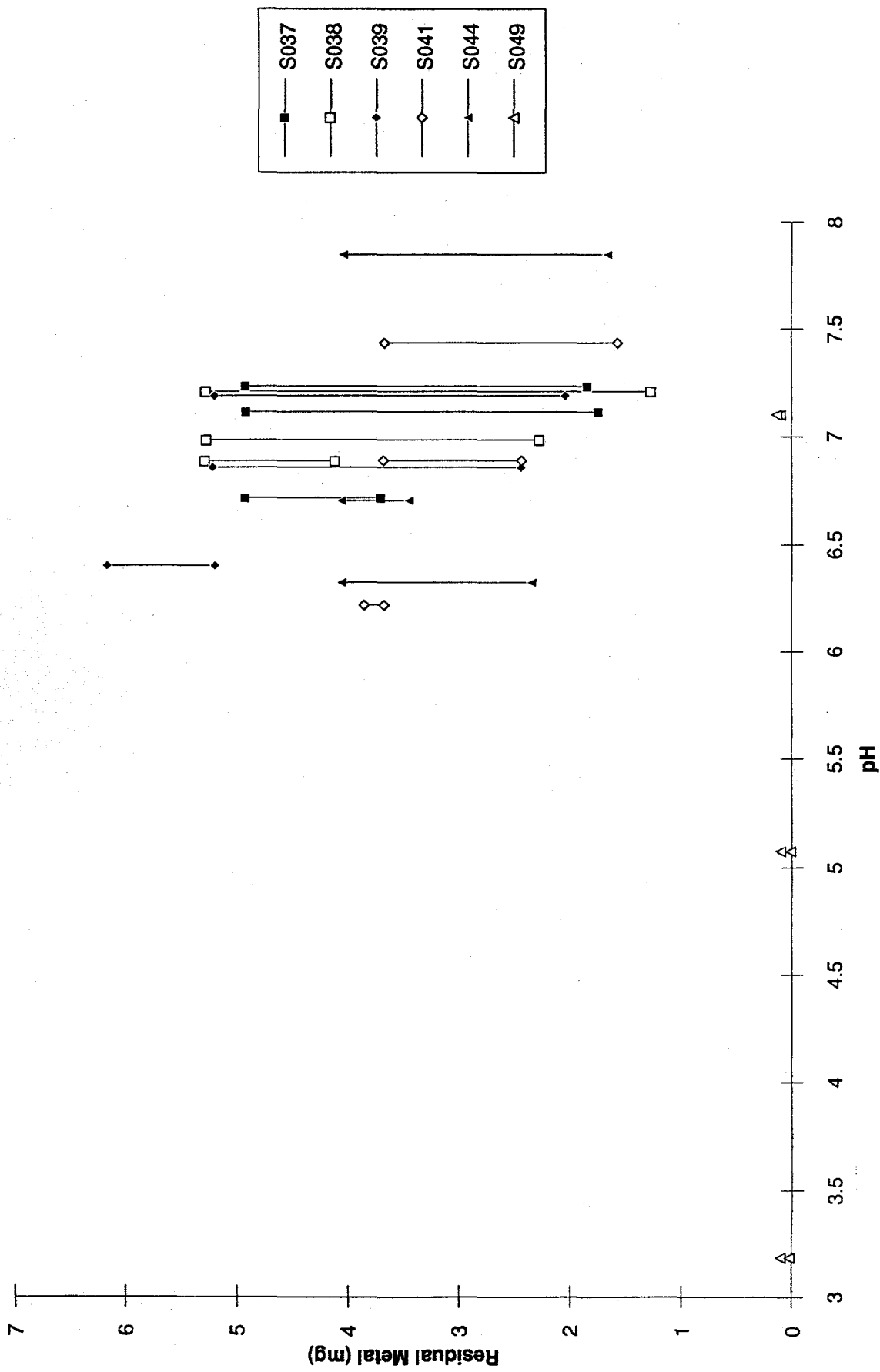


FIGURE 4 (Cont.)

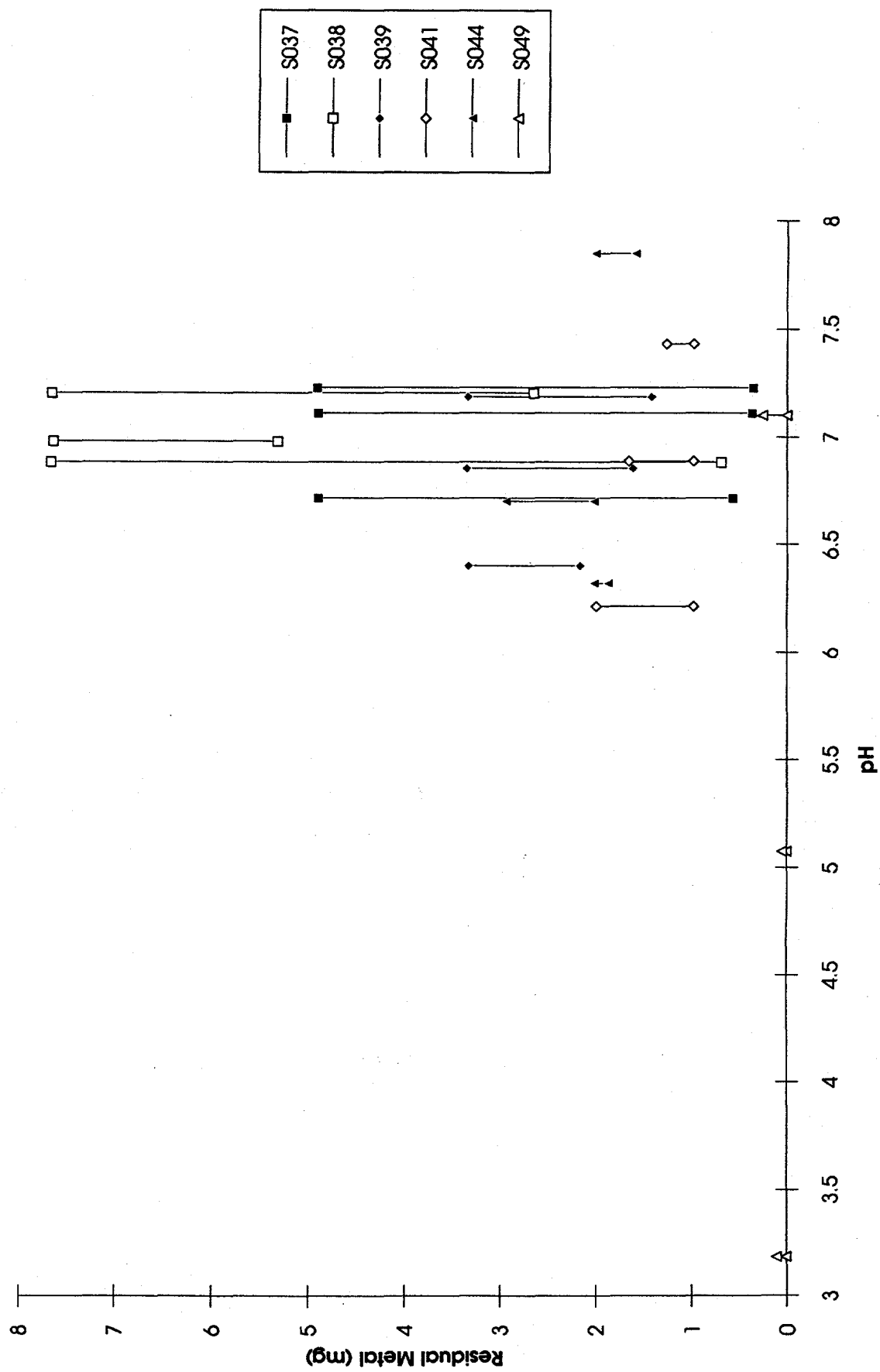


FIGURE 4 (Cont.)



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.<sup>3</sup> 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.

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

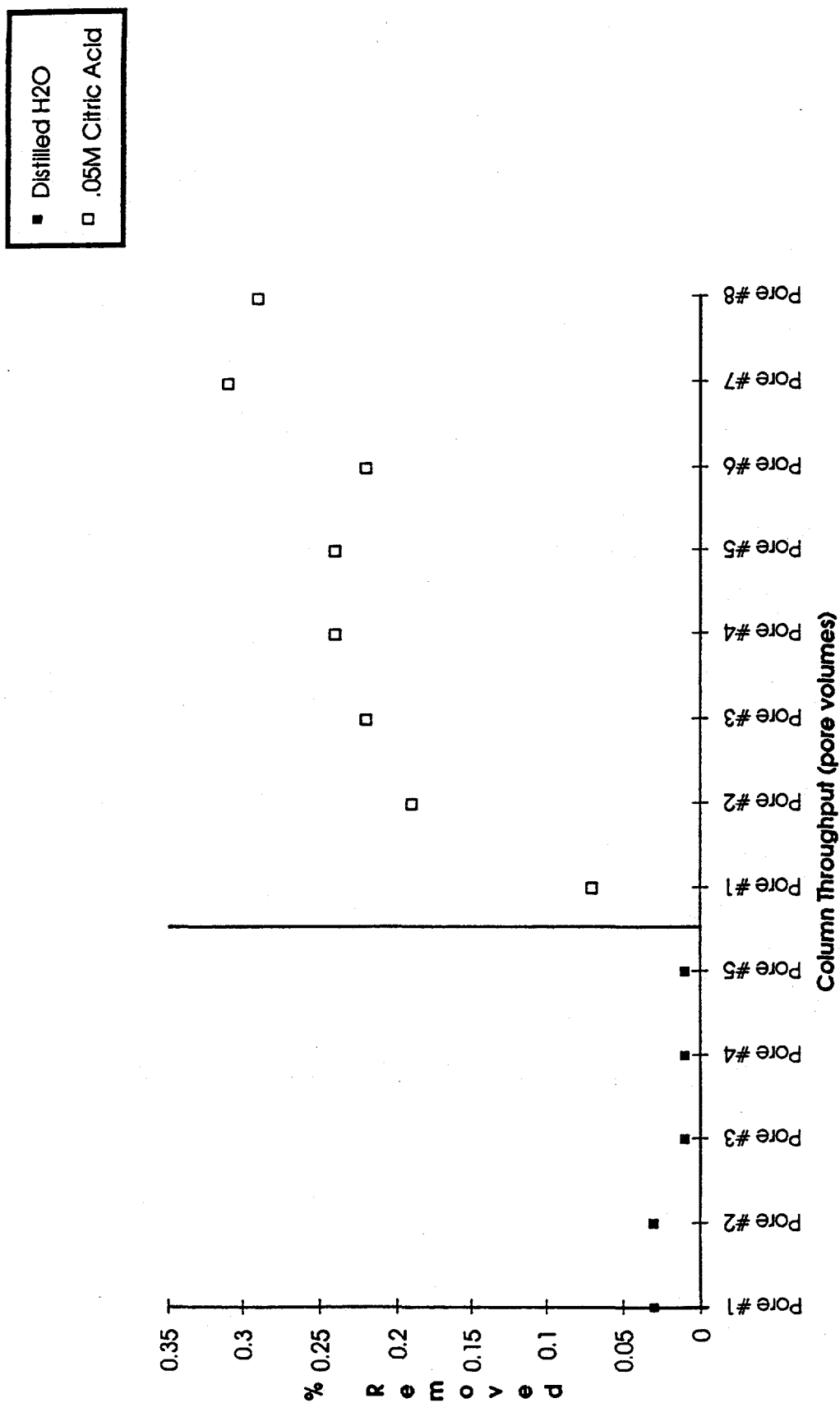


FIGURE 5 Columnar Extraction of Pb from Contaminated Soil, Using 0.05M Citric Acid or 0.05M EDTA

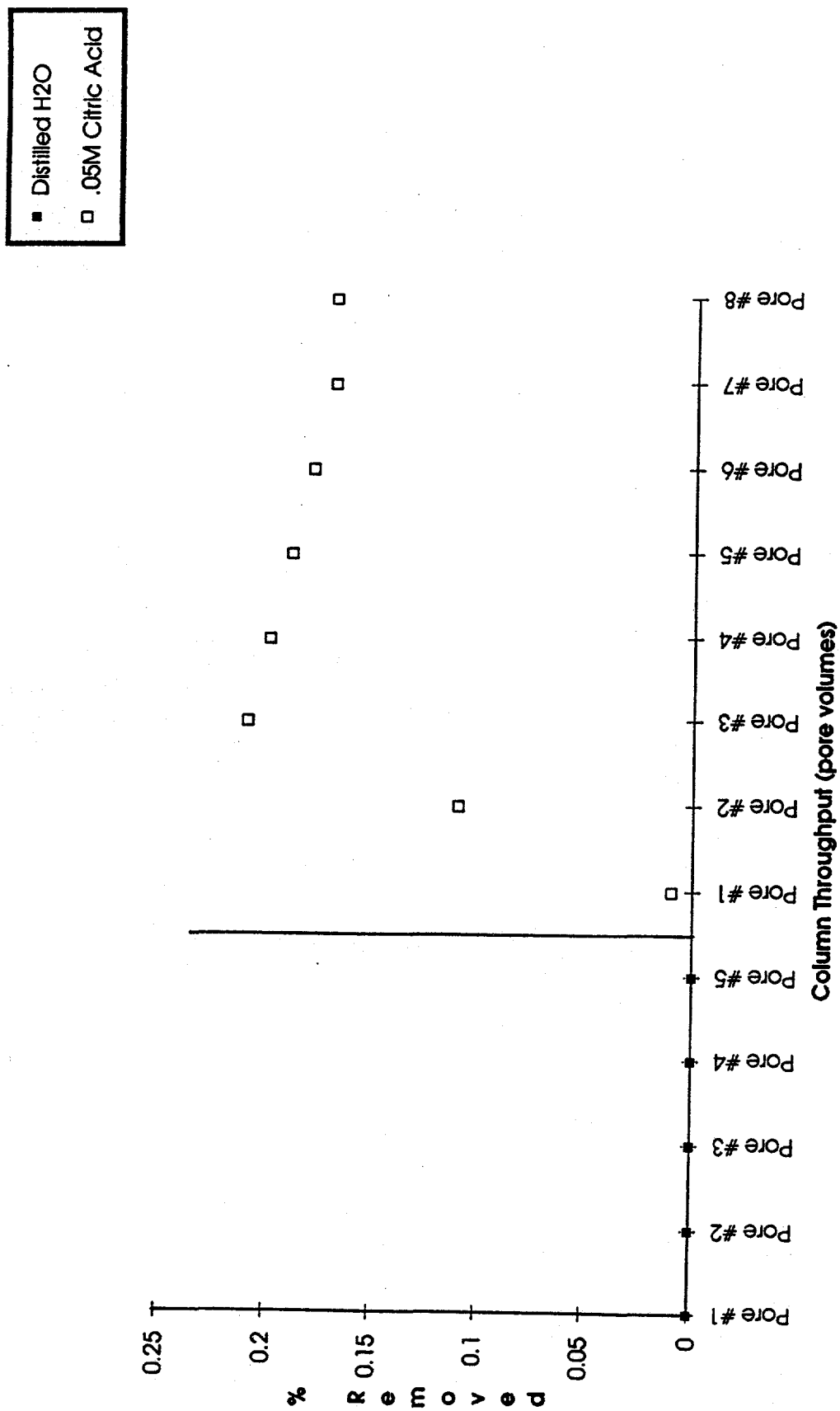


FIGURE 5 (Cont.)

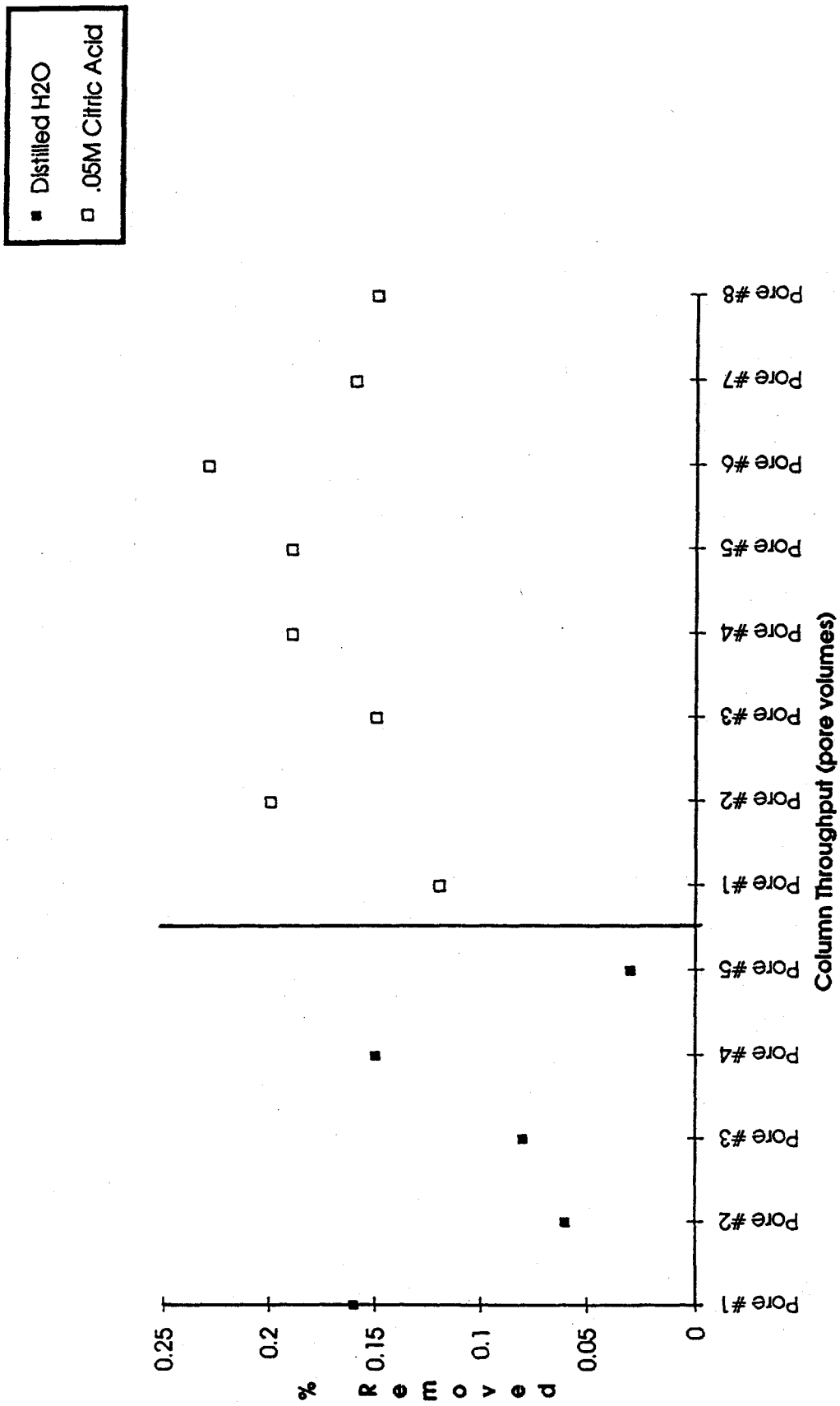


FIGURE 5 (Cont.)

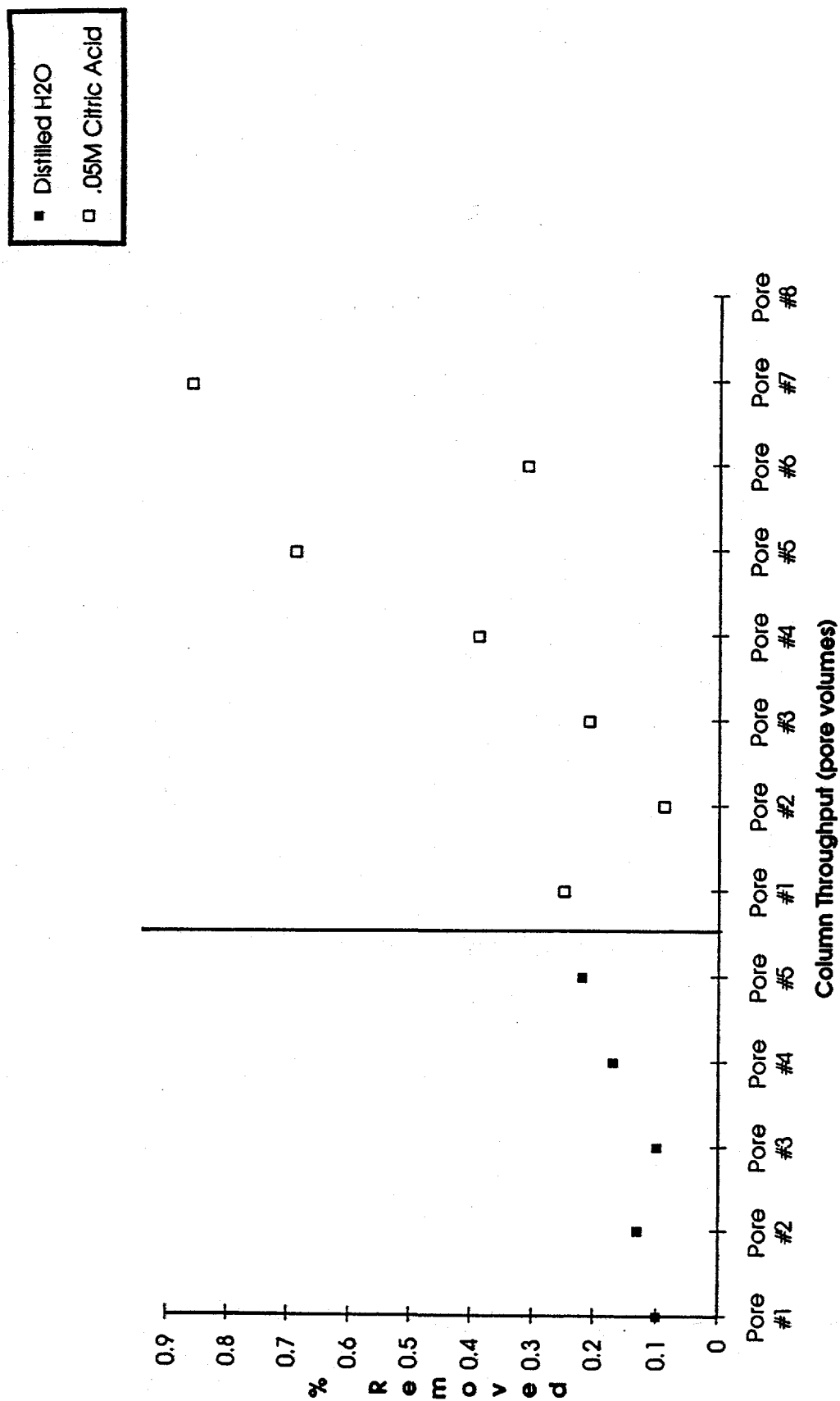


FIGURE 5 (Cont.)

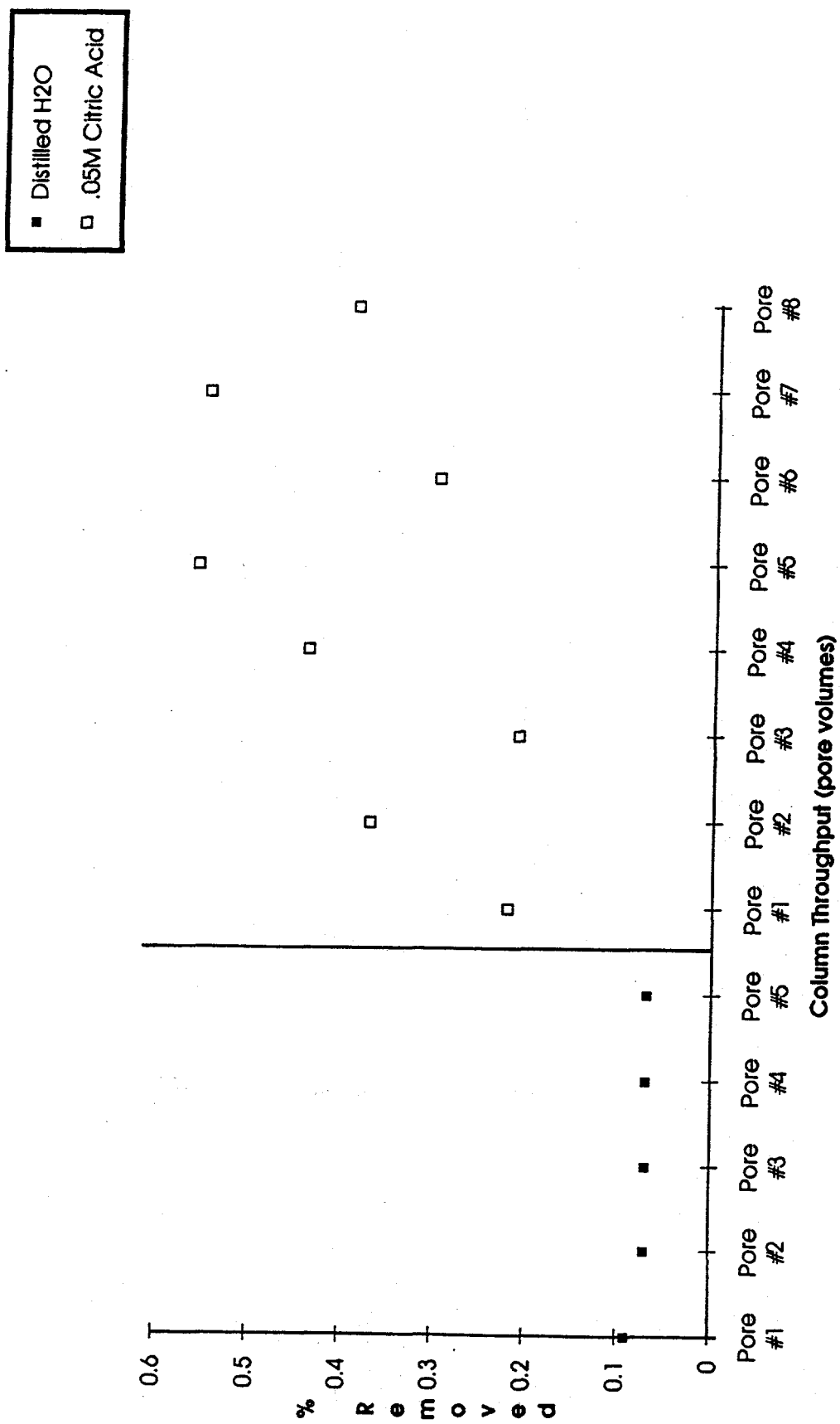


FIGURE 5 (Cont.)

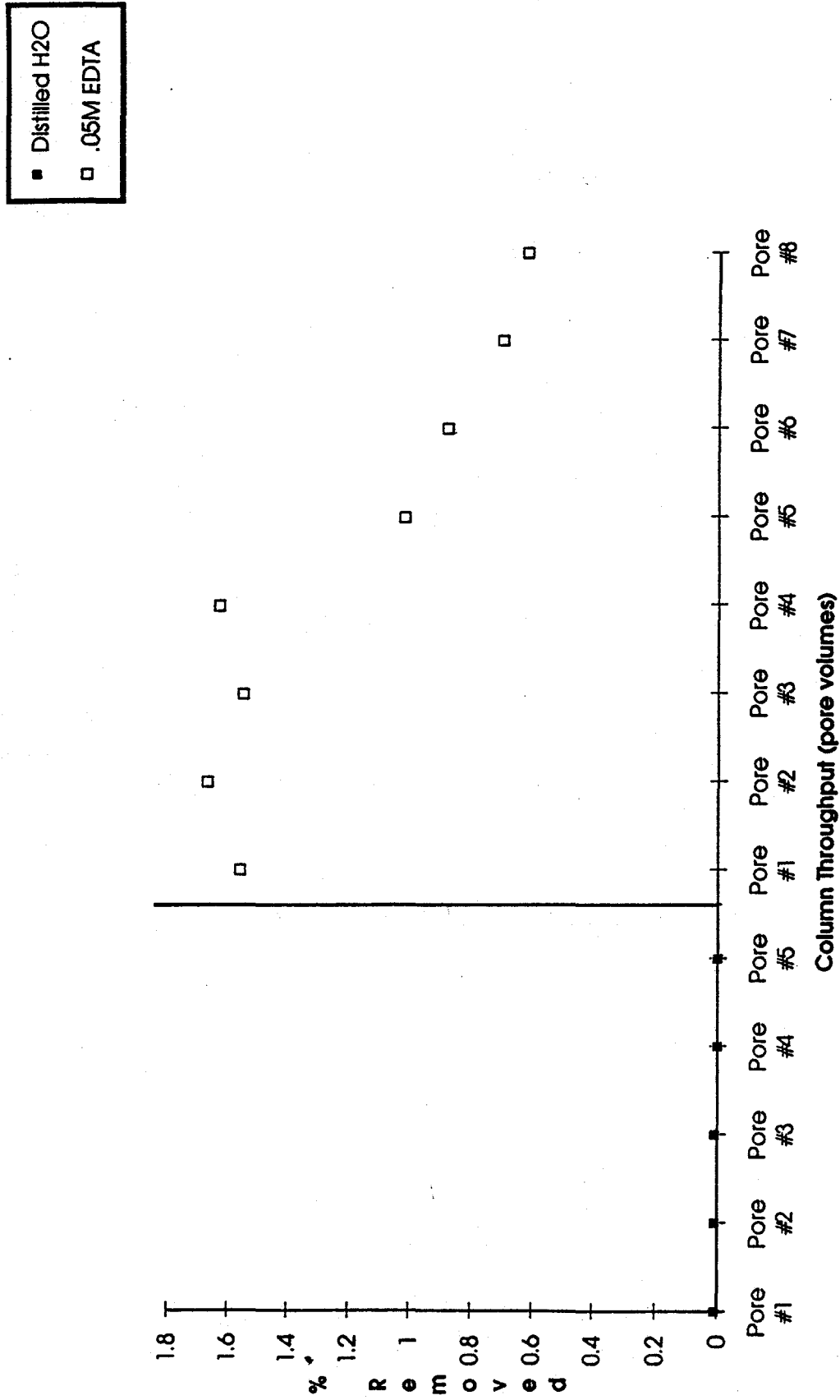


FIGURE 5 (Cont.)

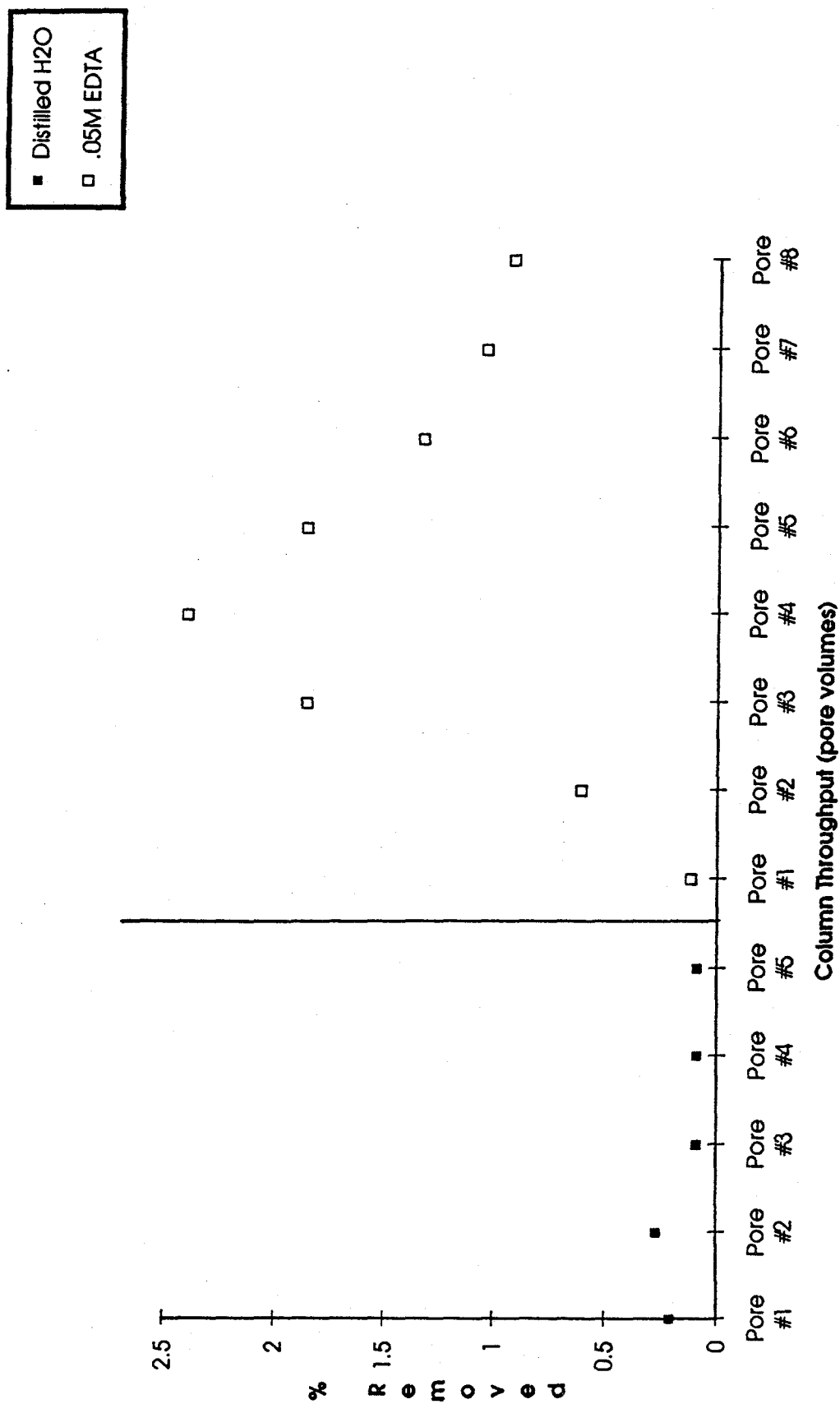


FIGURE 5 (Cont.)



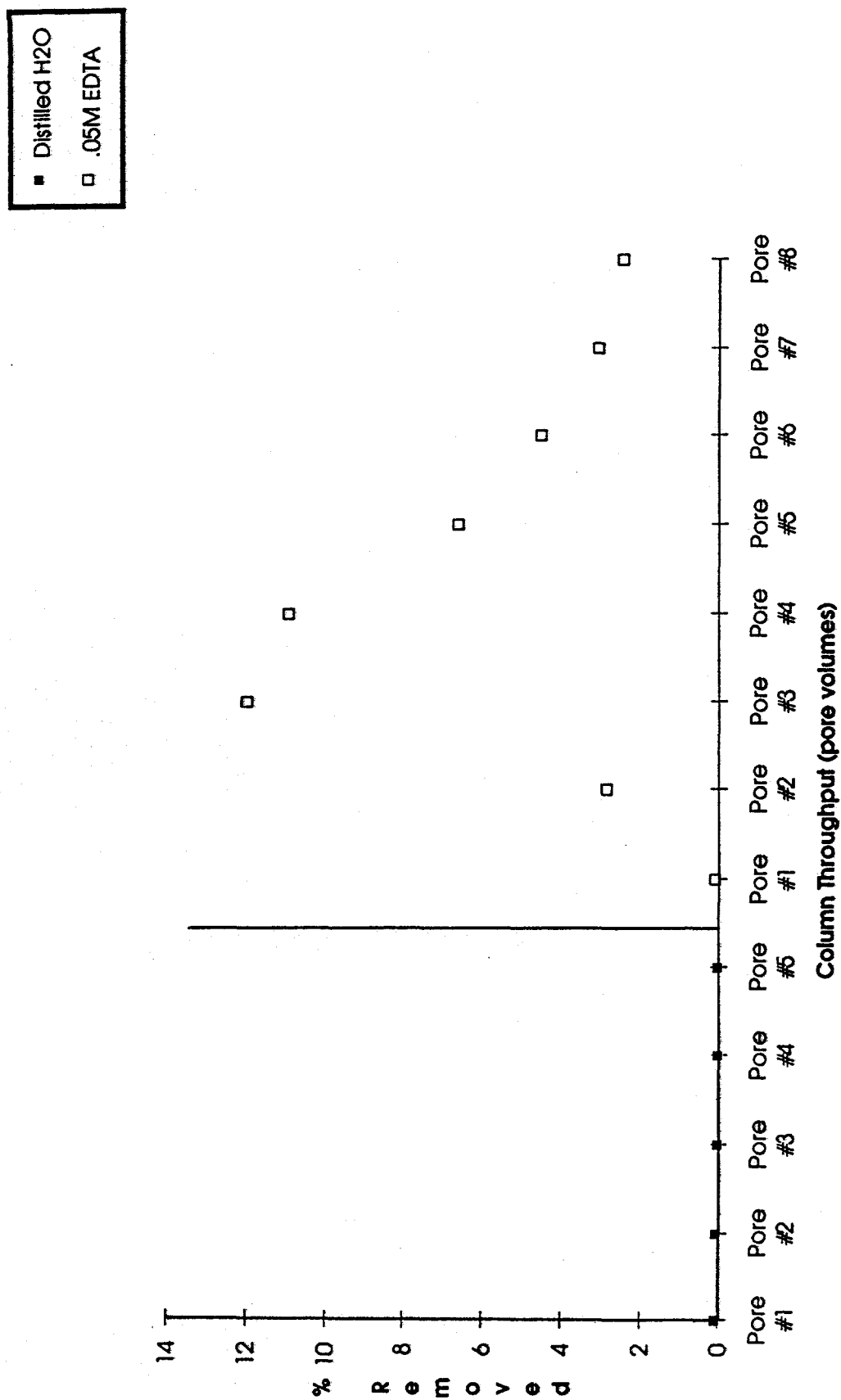


FIGURE 5 (Cont.)

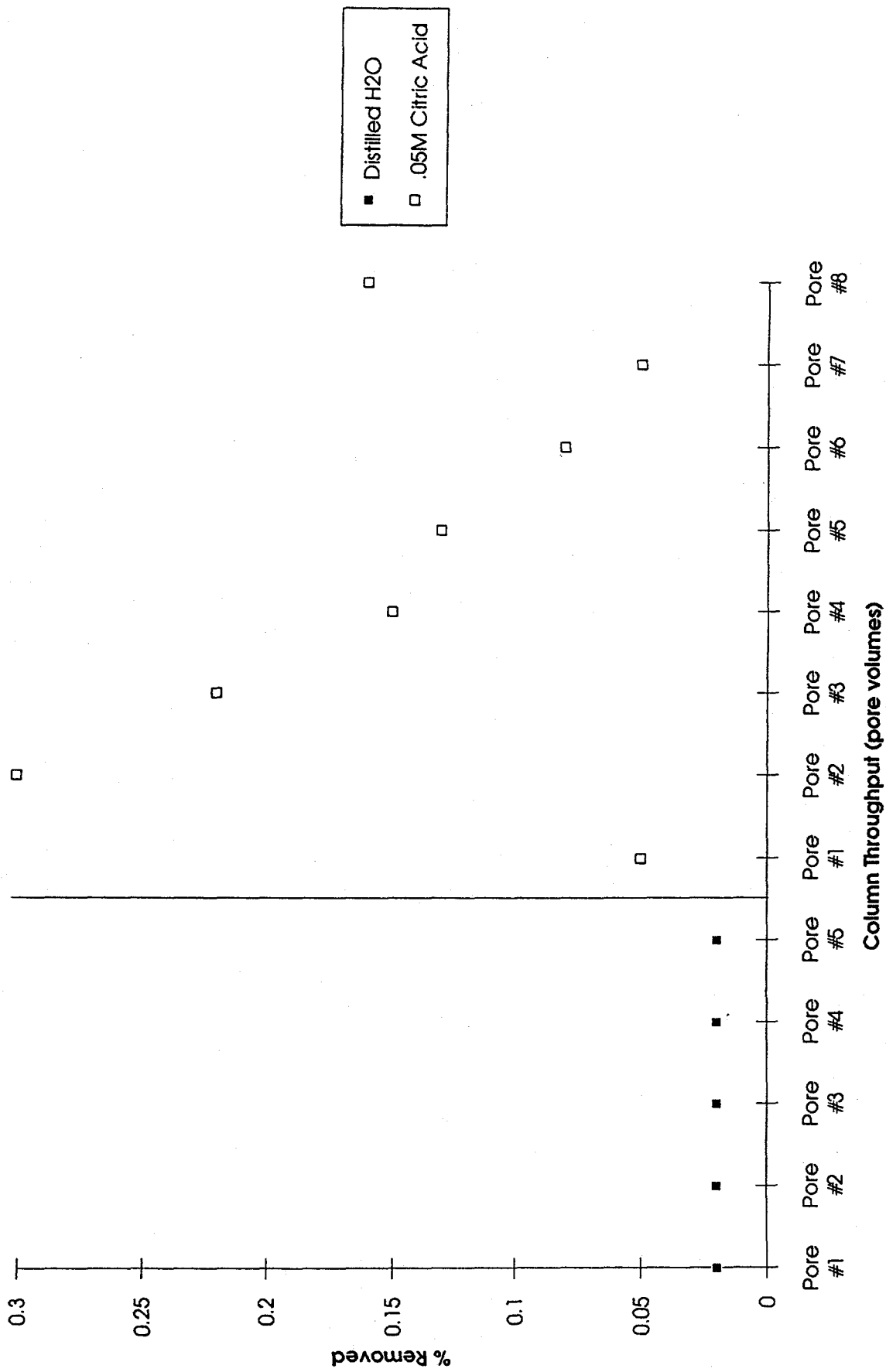


FIGURE 6 Columnar Extraction of Cd from Contaminated Soil, Using 0.05M Citric Acid or 0.05M EDTA

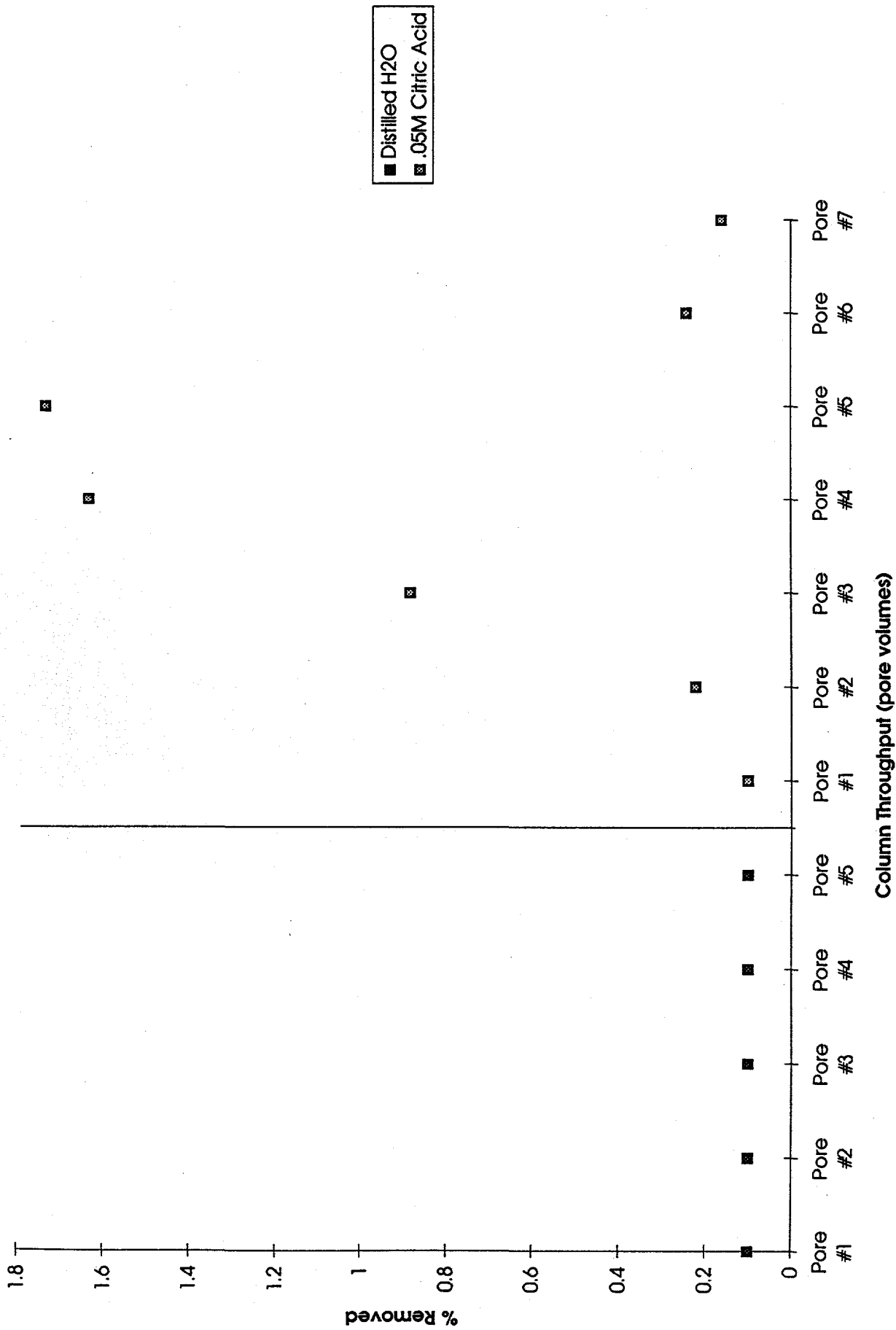


FIGURE 6 (Cont.)

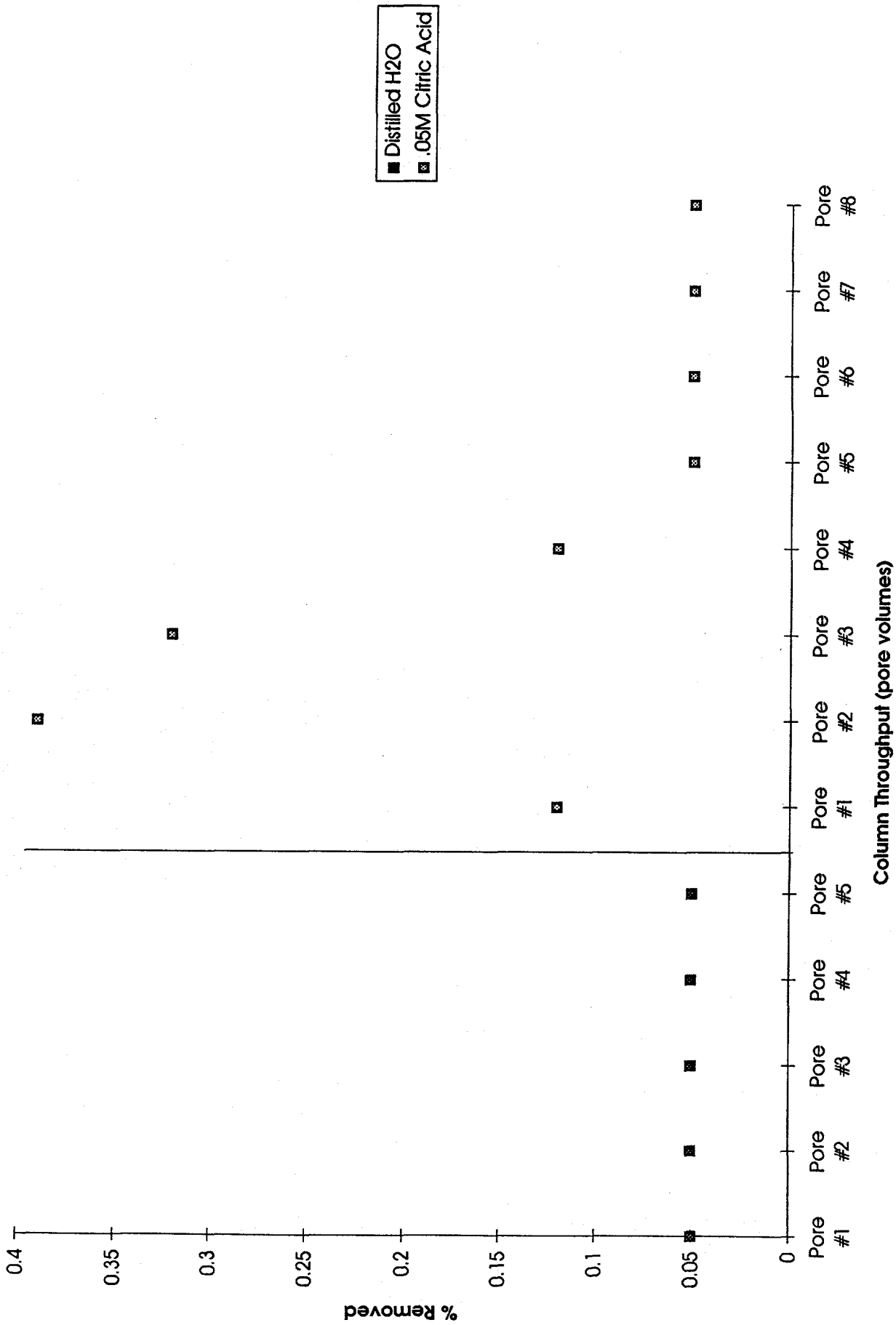


FIGURE 6 (Cont.)

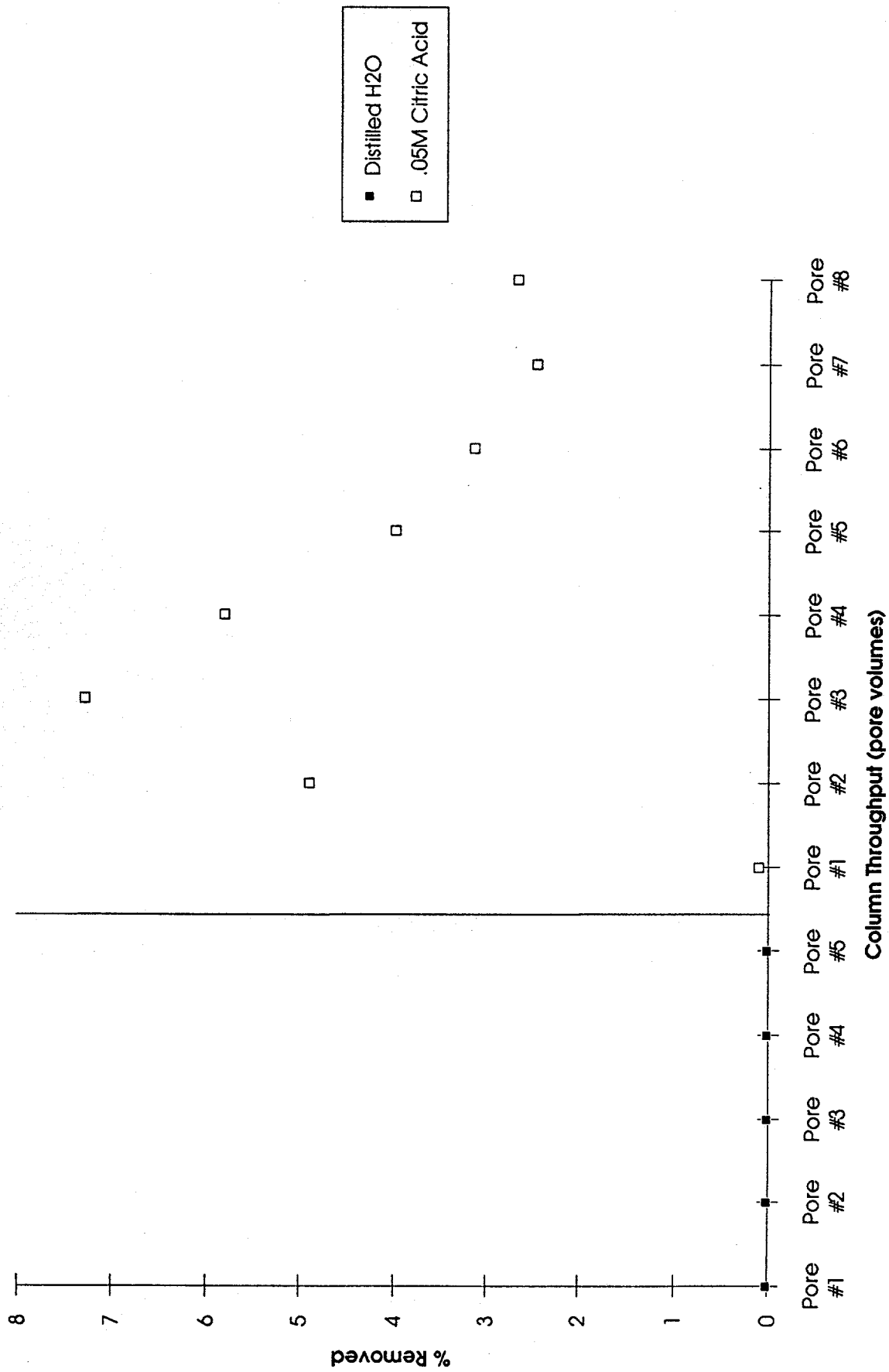


FIGURE 6 (Cont.)

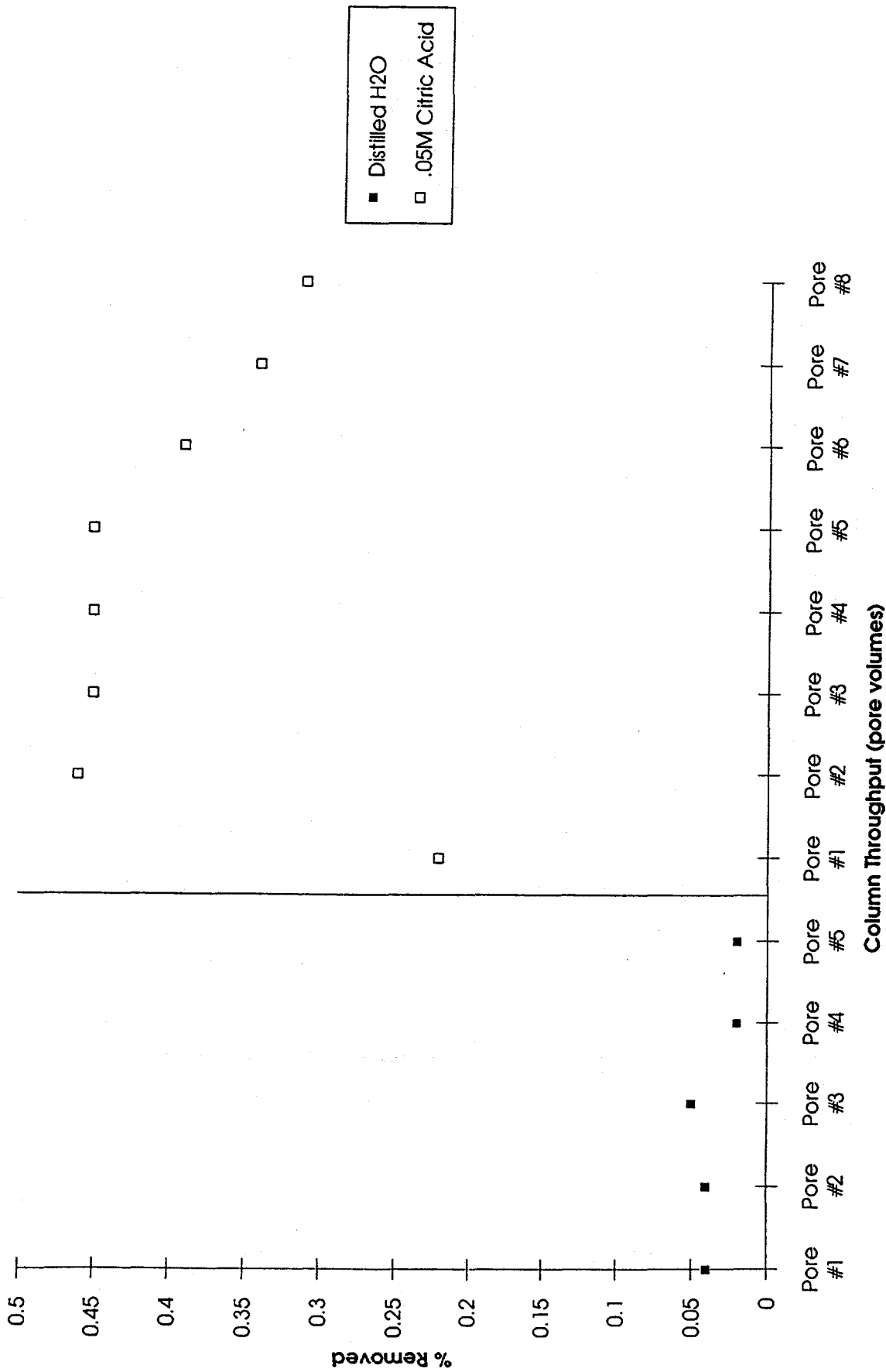


FIGURE 7 Columnar Extraction of Cu from Contaminated Soil, Using 0.05M Citric Acid or 0.05M EDTA

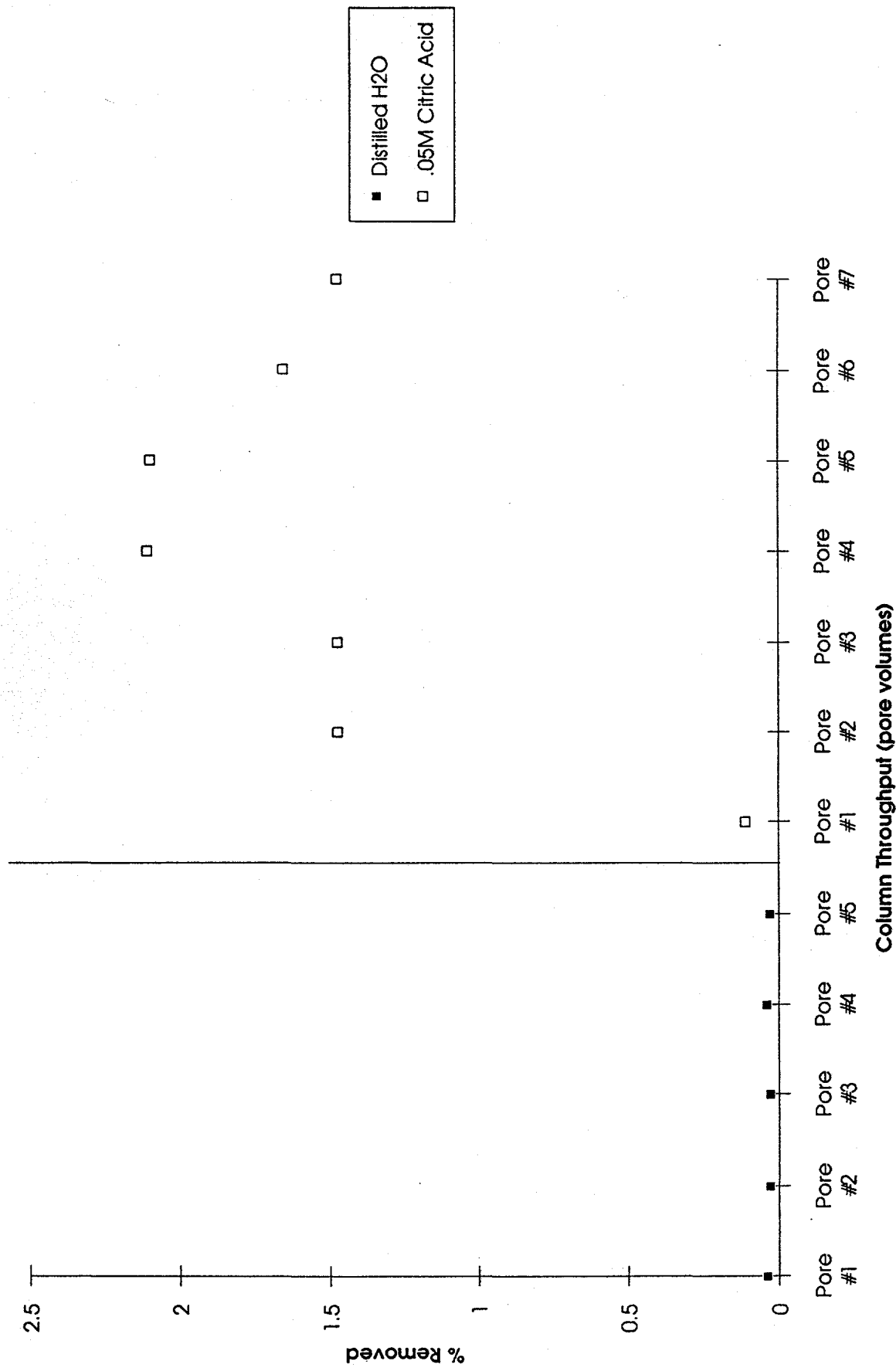


FIGURE 7 (Cont.)

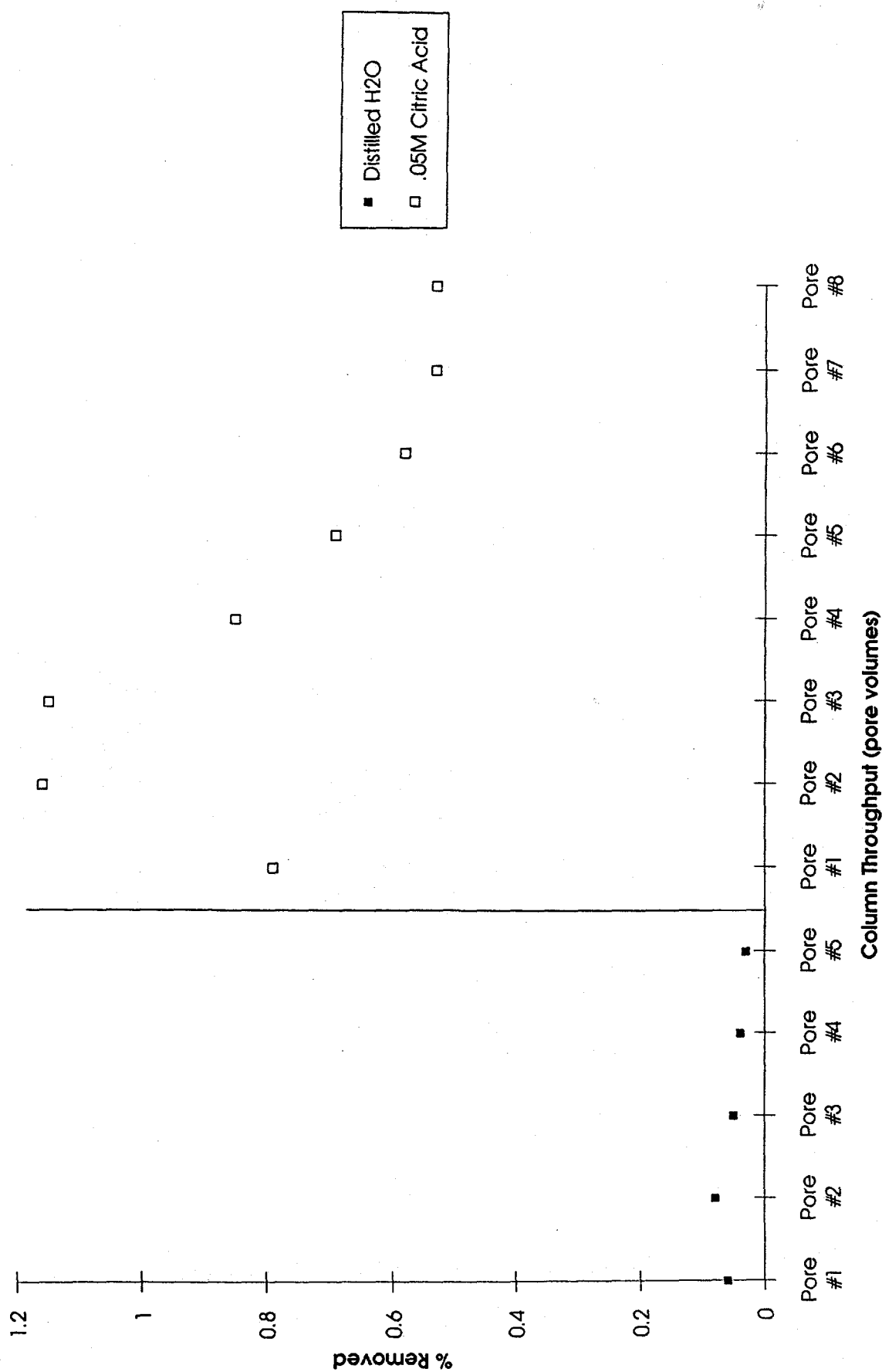


FIGURE 7 (Cont.)



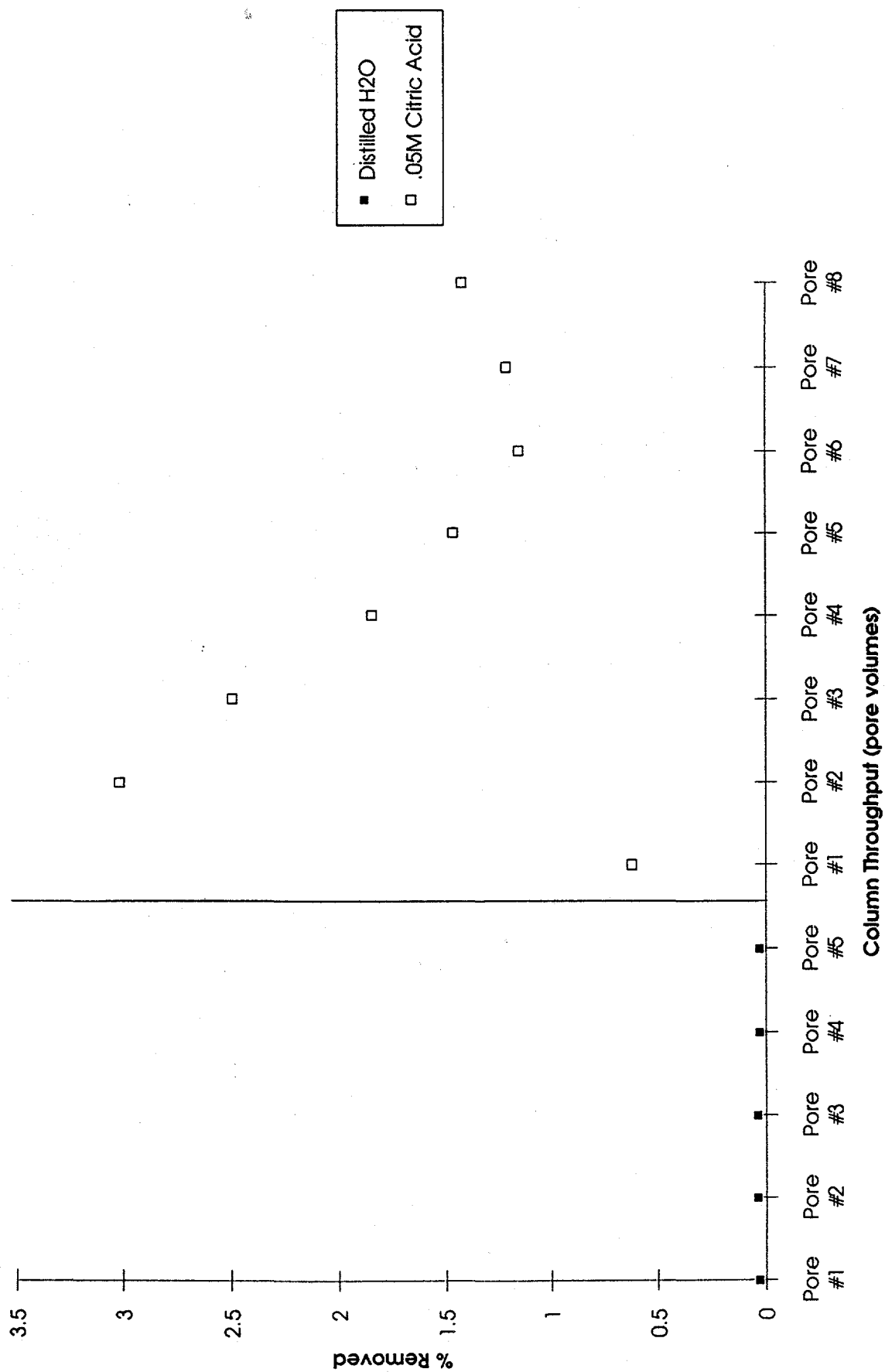


FIGURE 7 (Cont.)

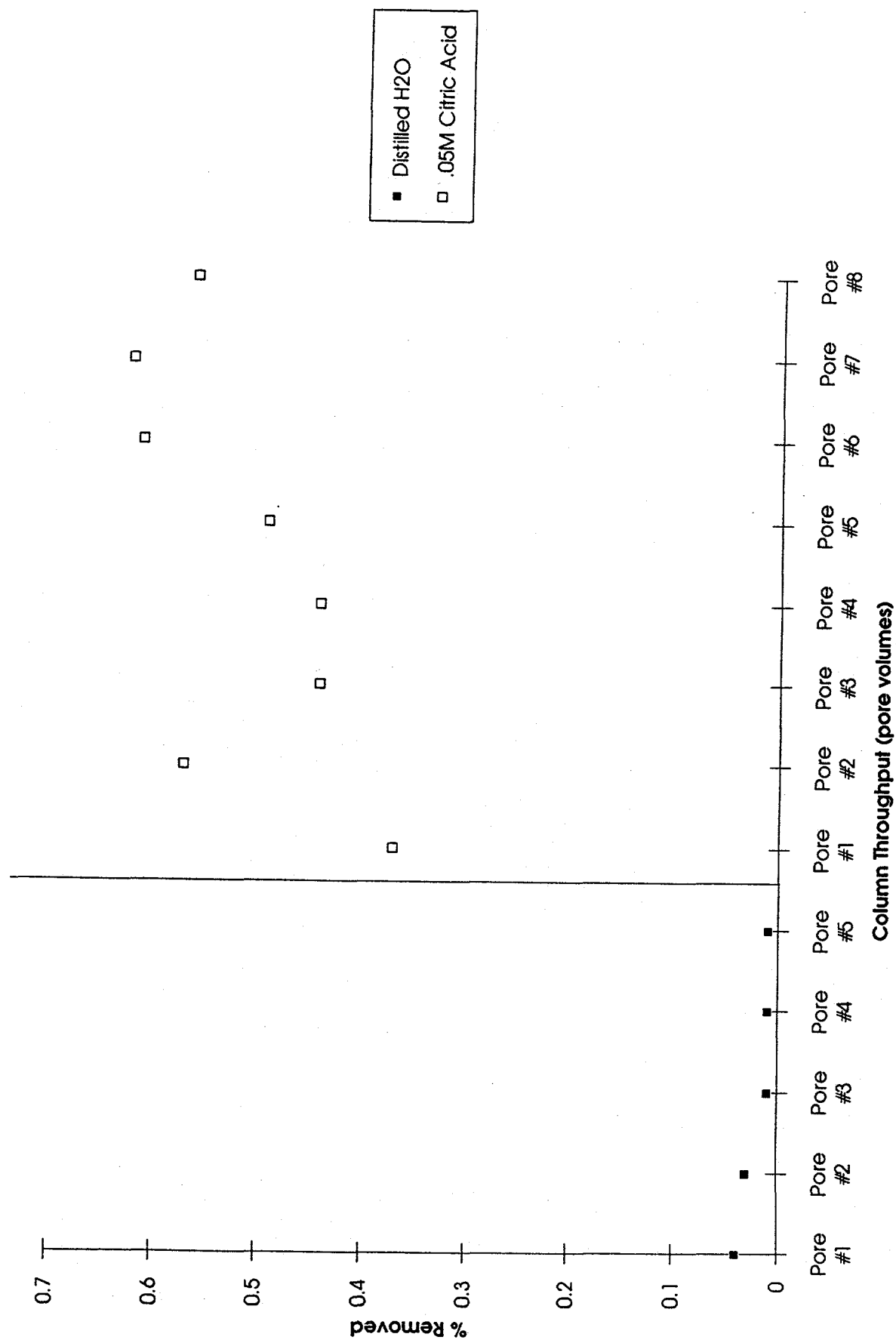


FIGURE 7 (Cont.)

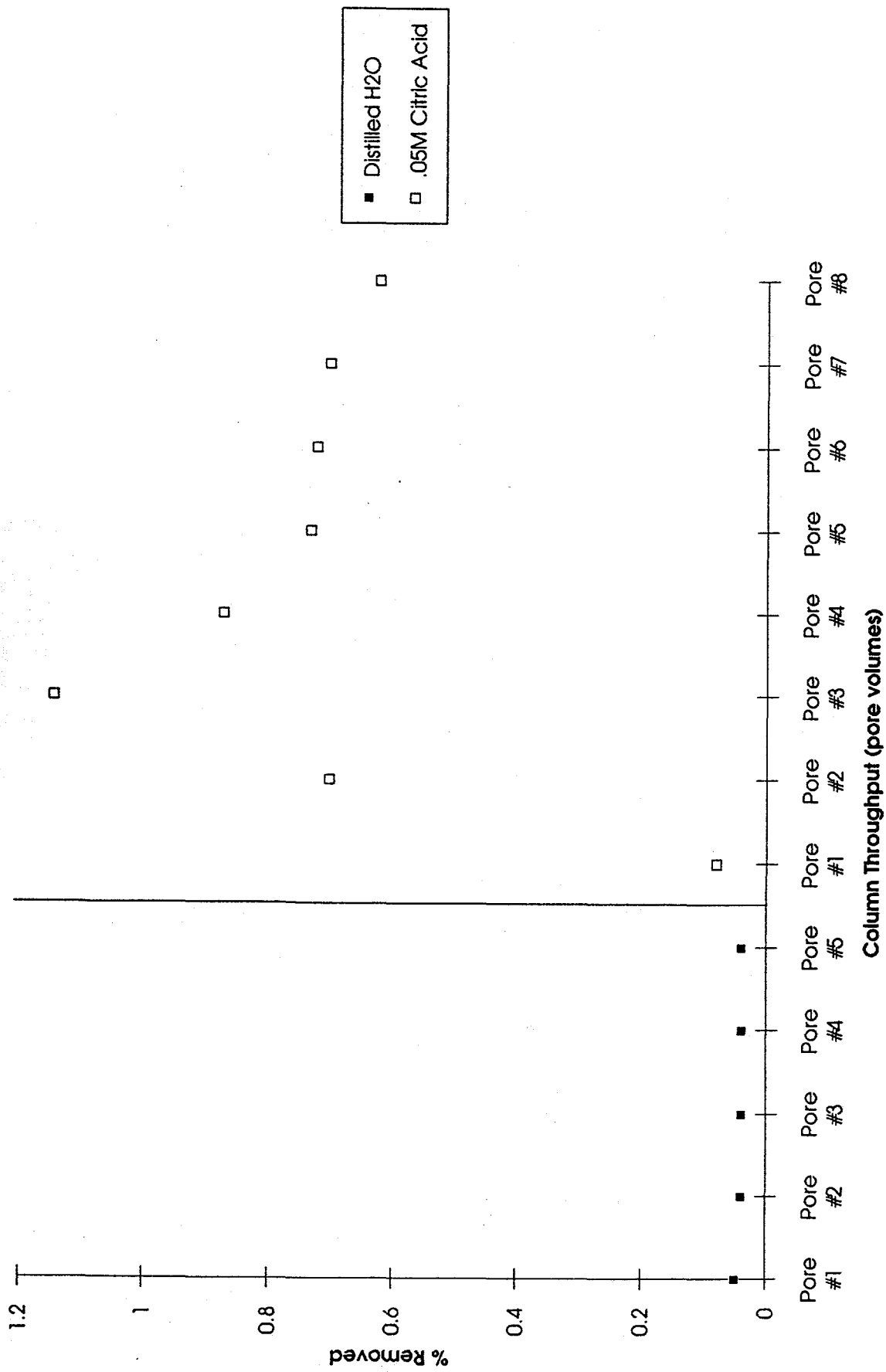


FIGURE 7 (Cont.)

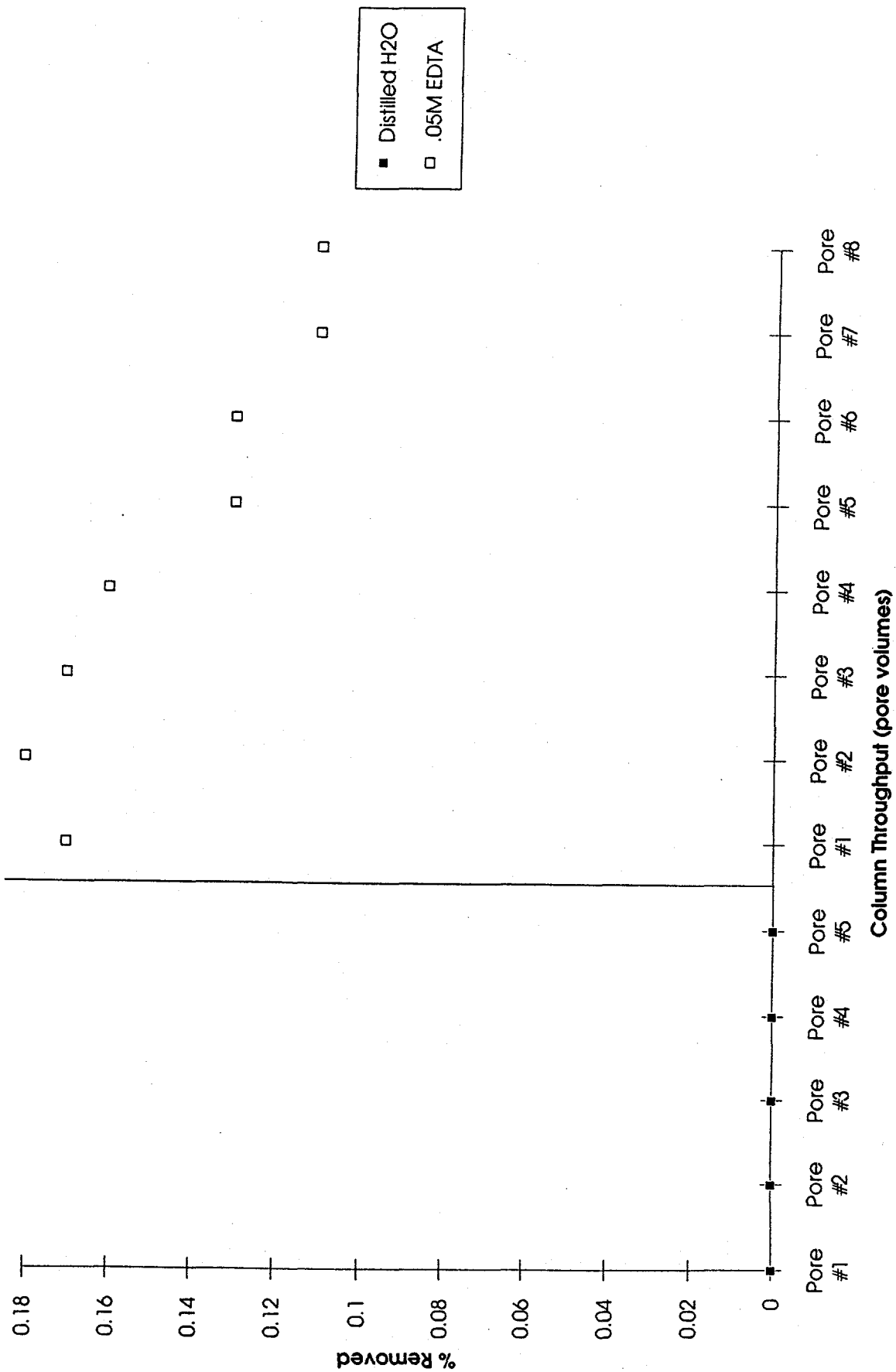


FIGURE 7 (Cont.)

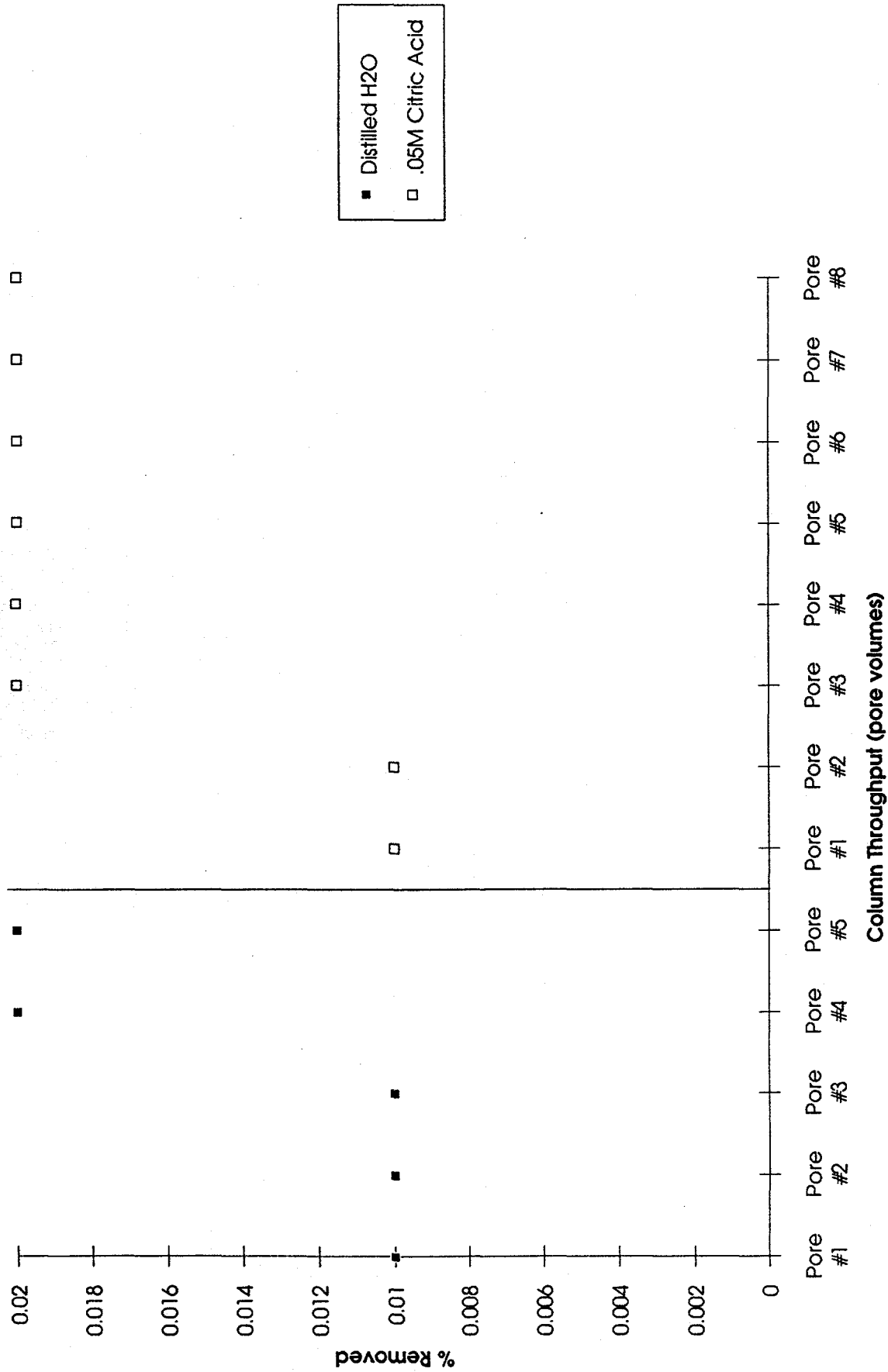


FIGURE 8 Columnar Extraction of Fe from Contaminated Soil, Using 0.05M Citric Acid or 0.05M EDTA

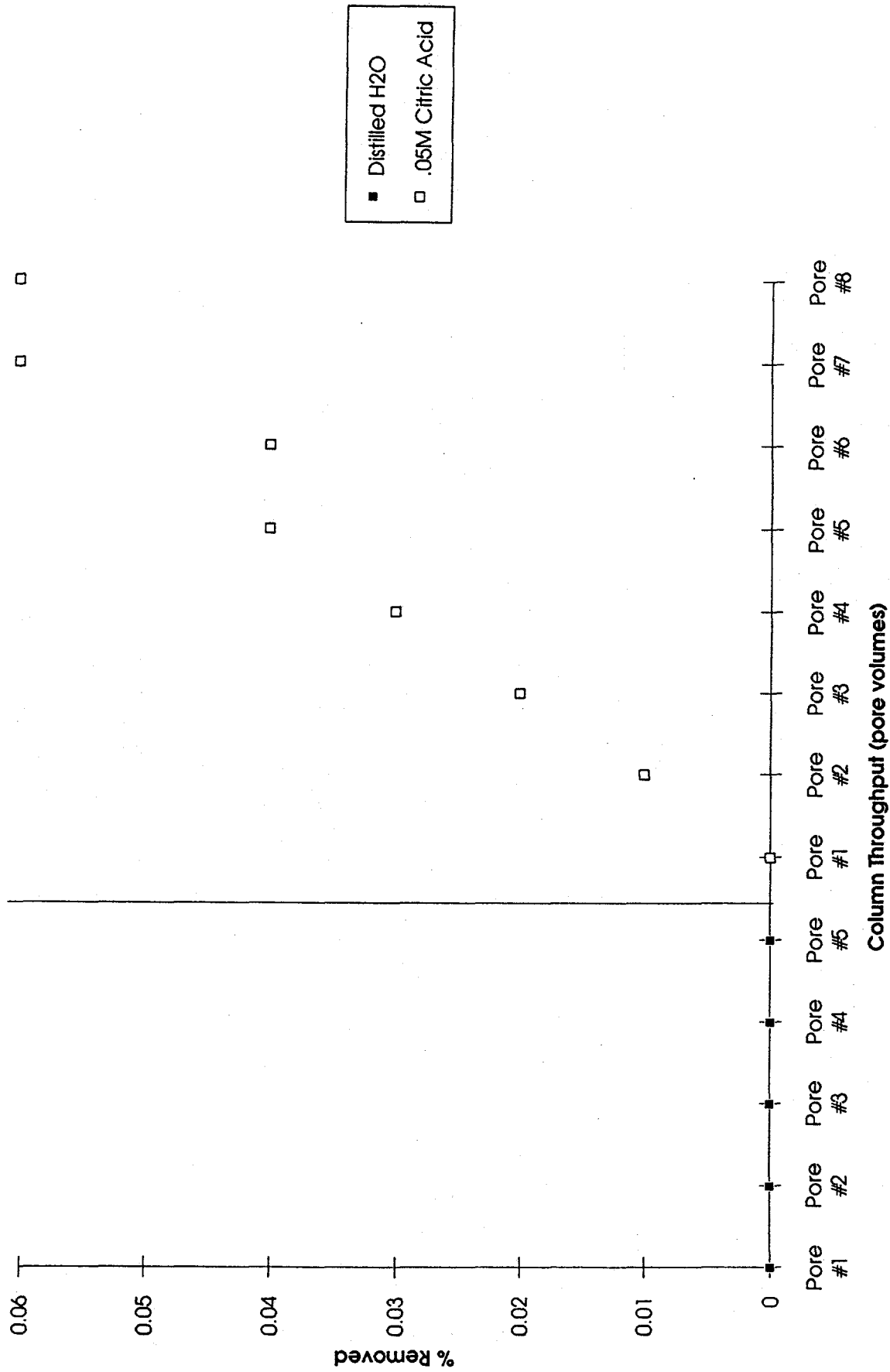


FIGURE 8 (Cont.)

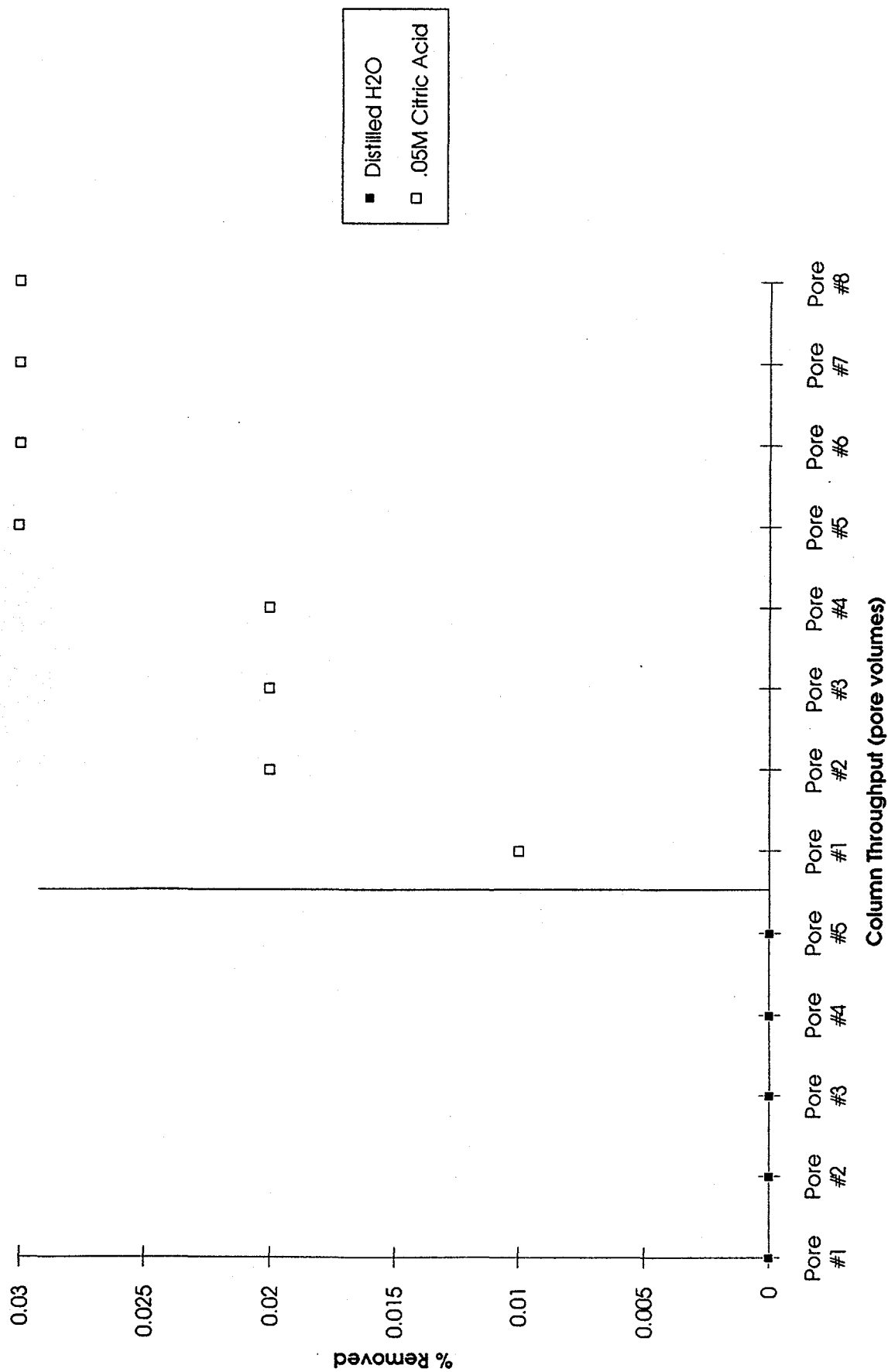


FIGURE 8 (Cont.)

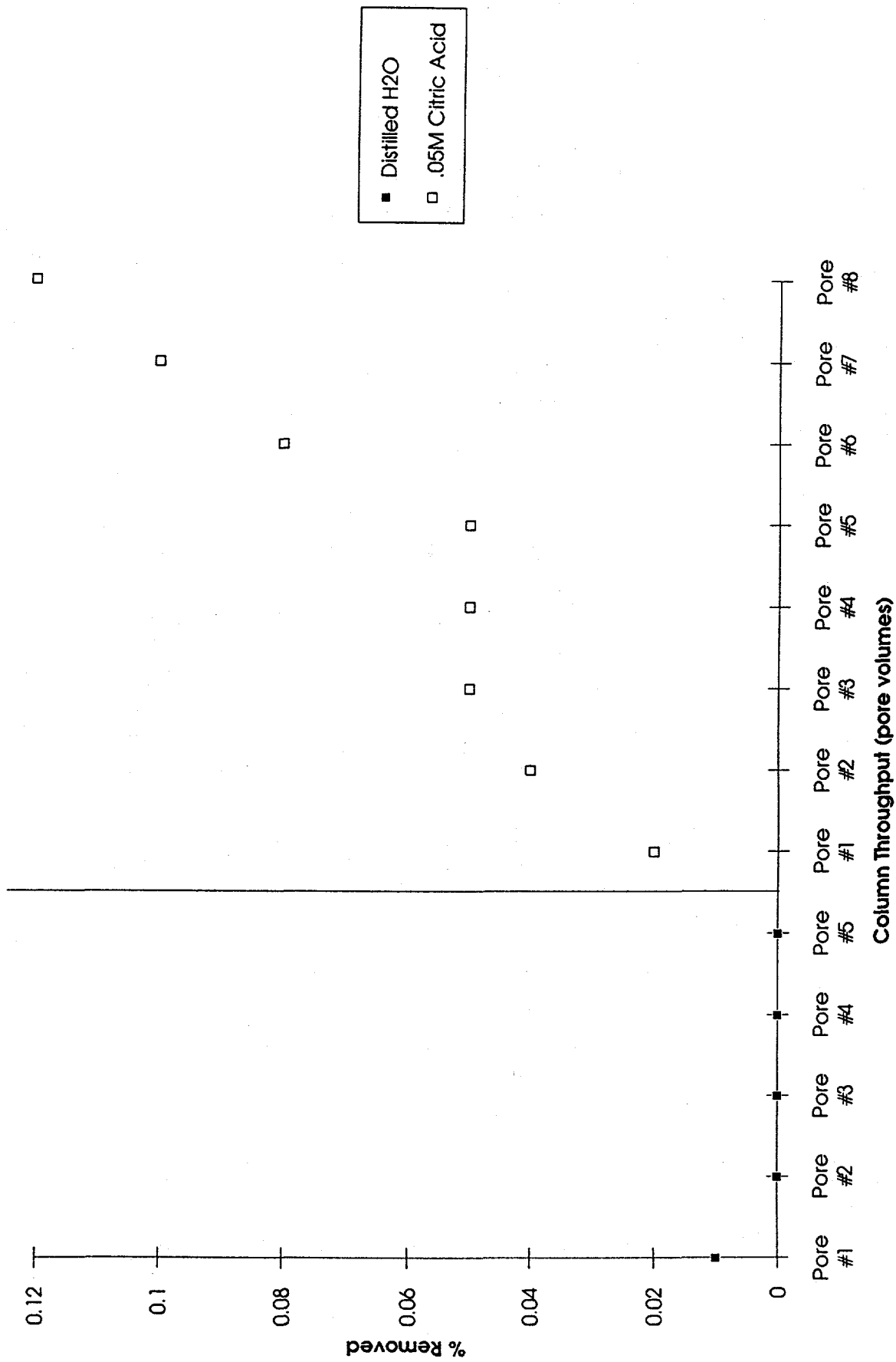


FIGURE 8 (Cont.)



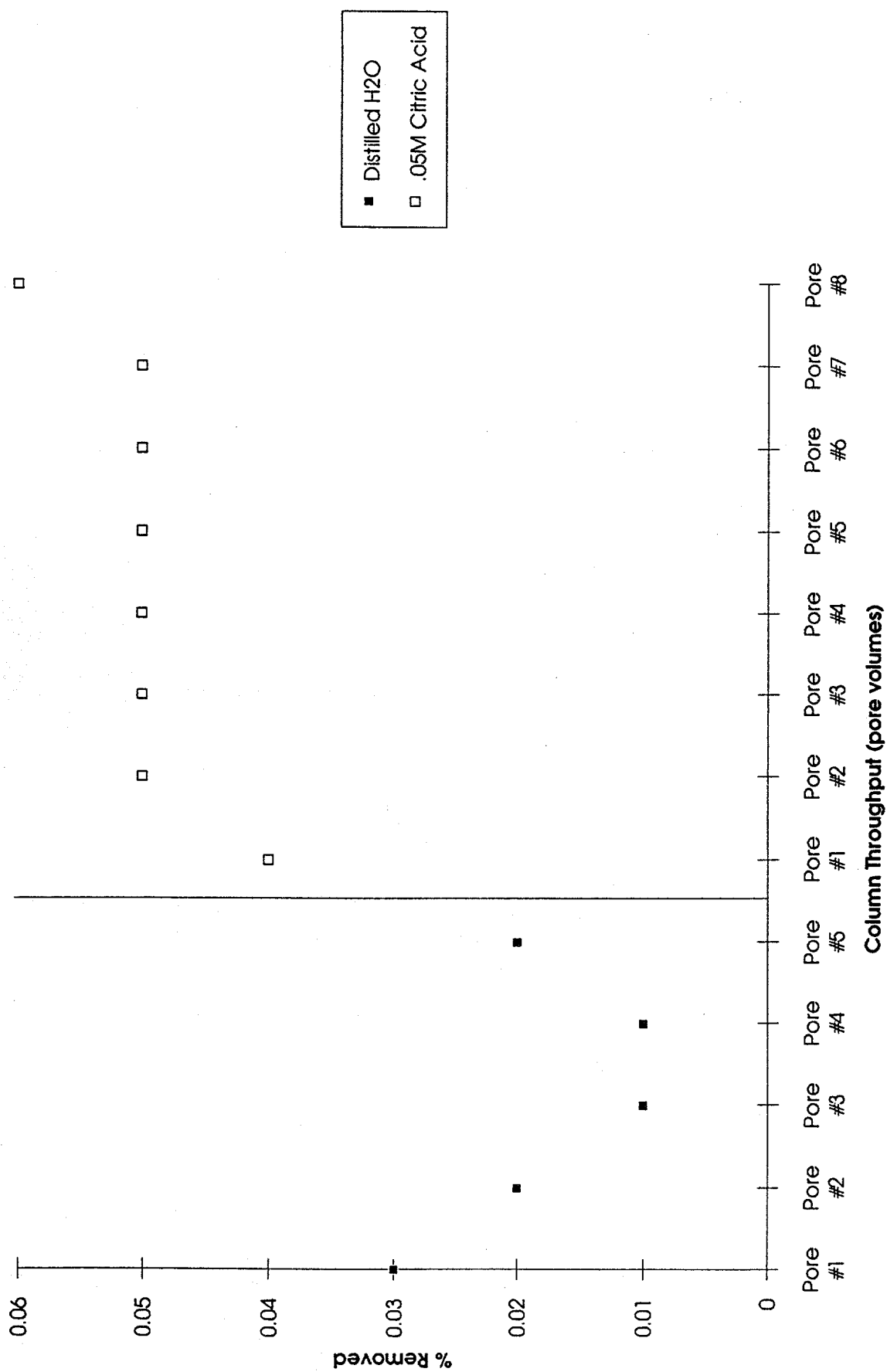


FIGURE 8 (Cont.)

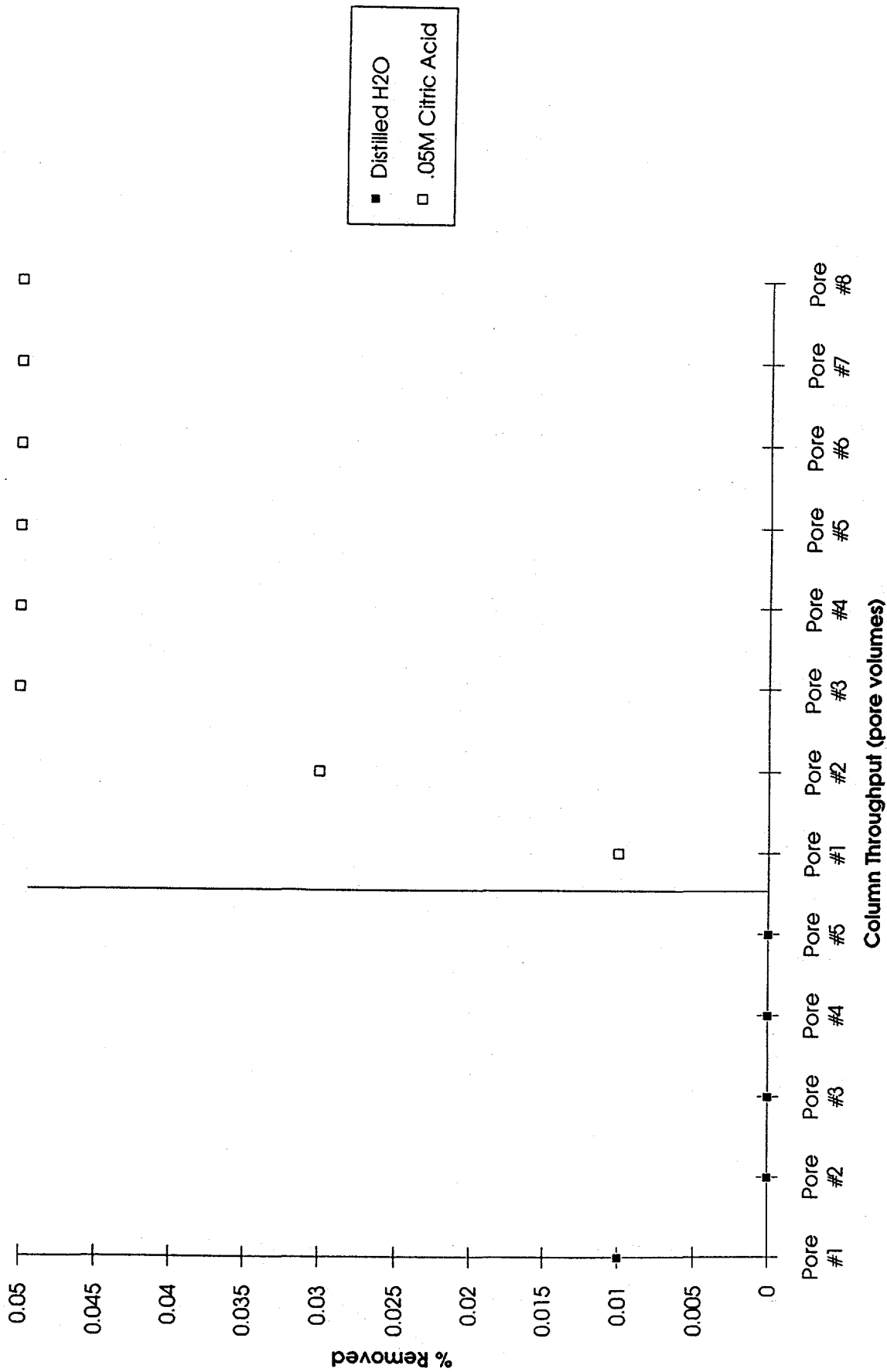


FIGURE 8 (Cont.)

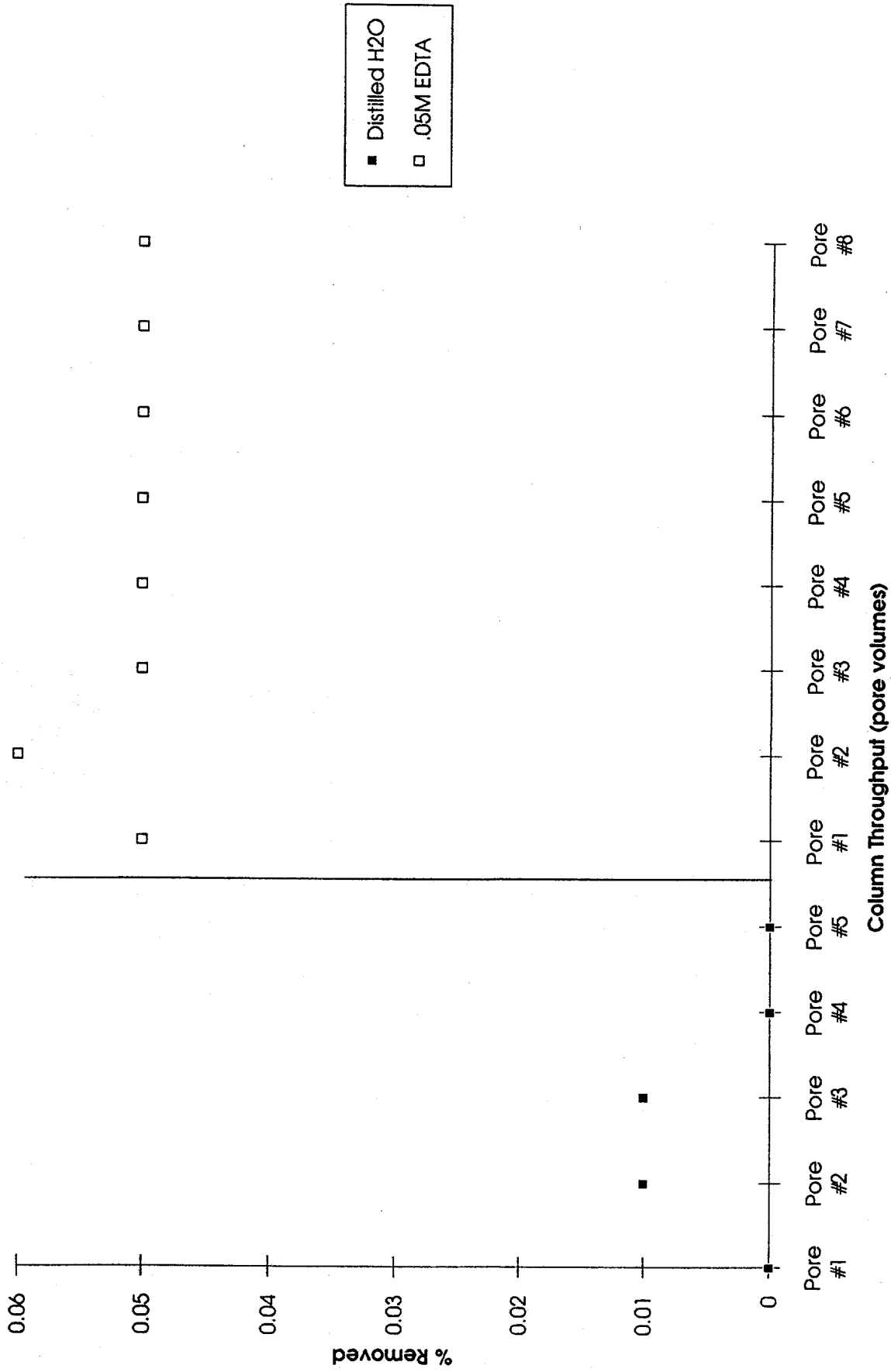


FIGURE 8 (Cont.)

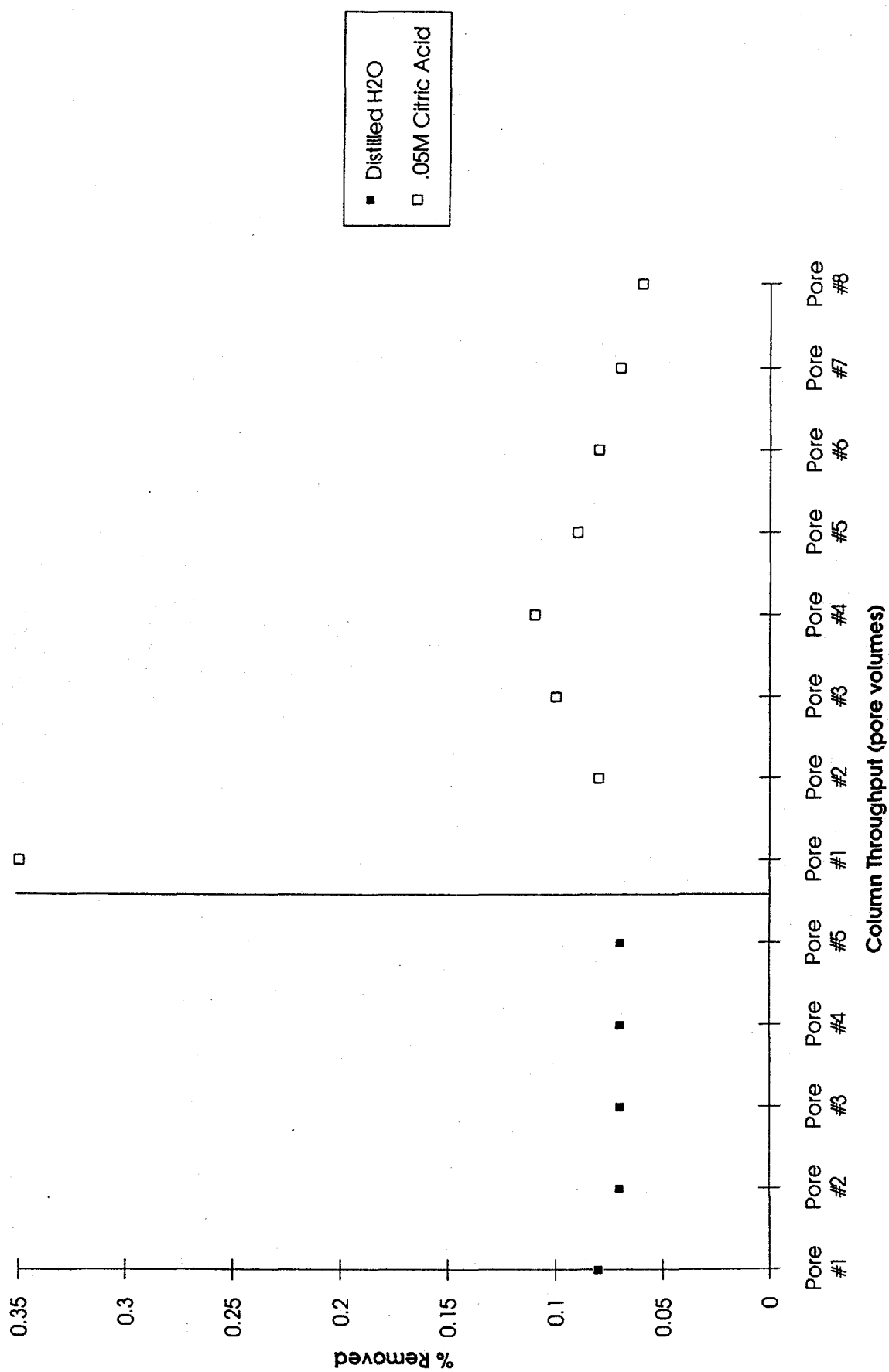


FIGURE 9 Columnar Extraction of Zn from Contaminated Soil, Using 0.05M Citric Acid or 0.05M EDTA

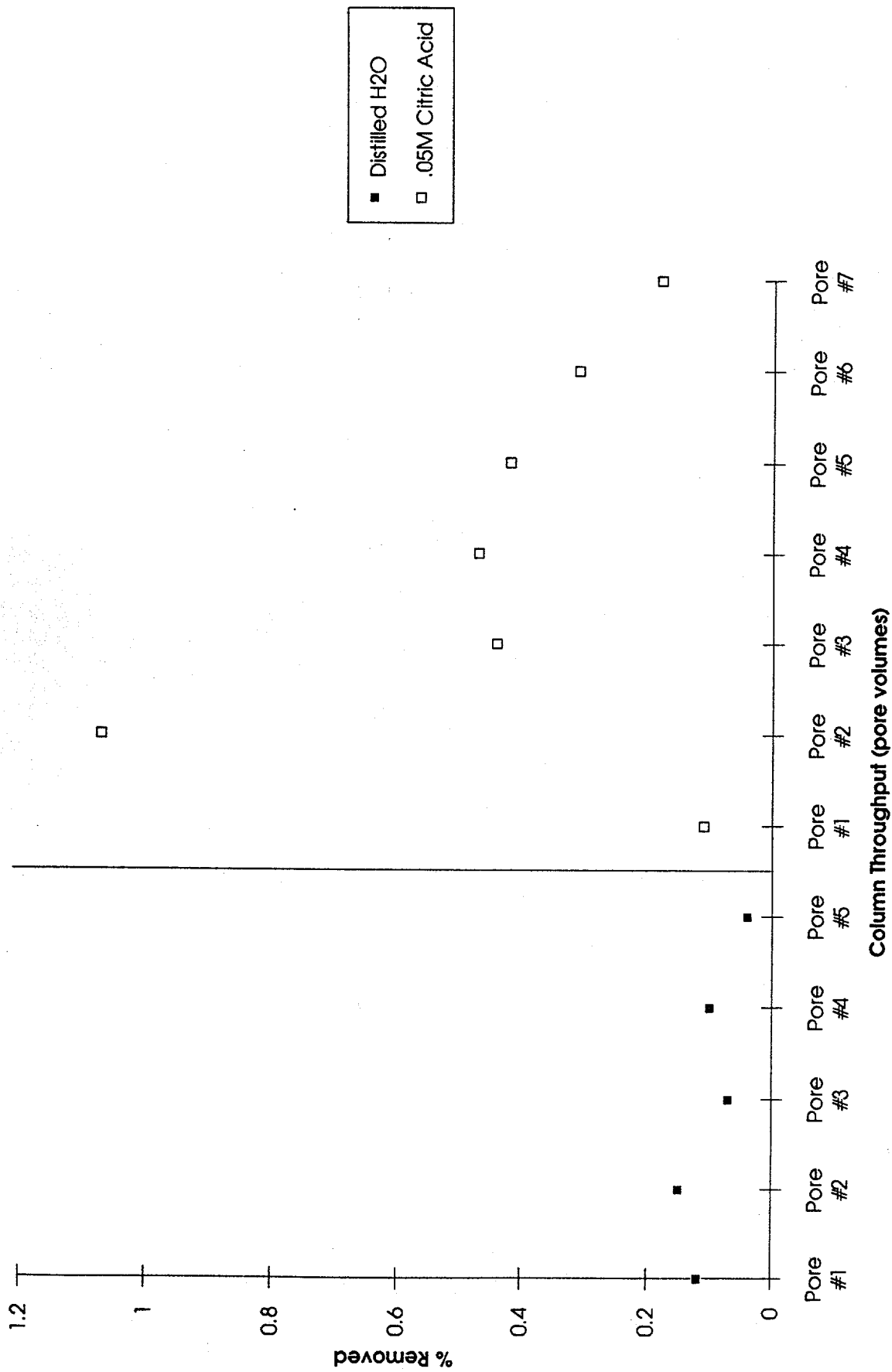


FIGURE 9 (Cont.)

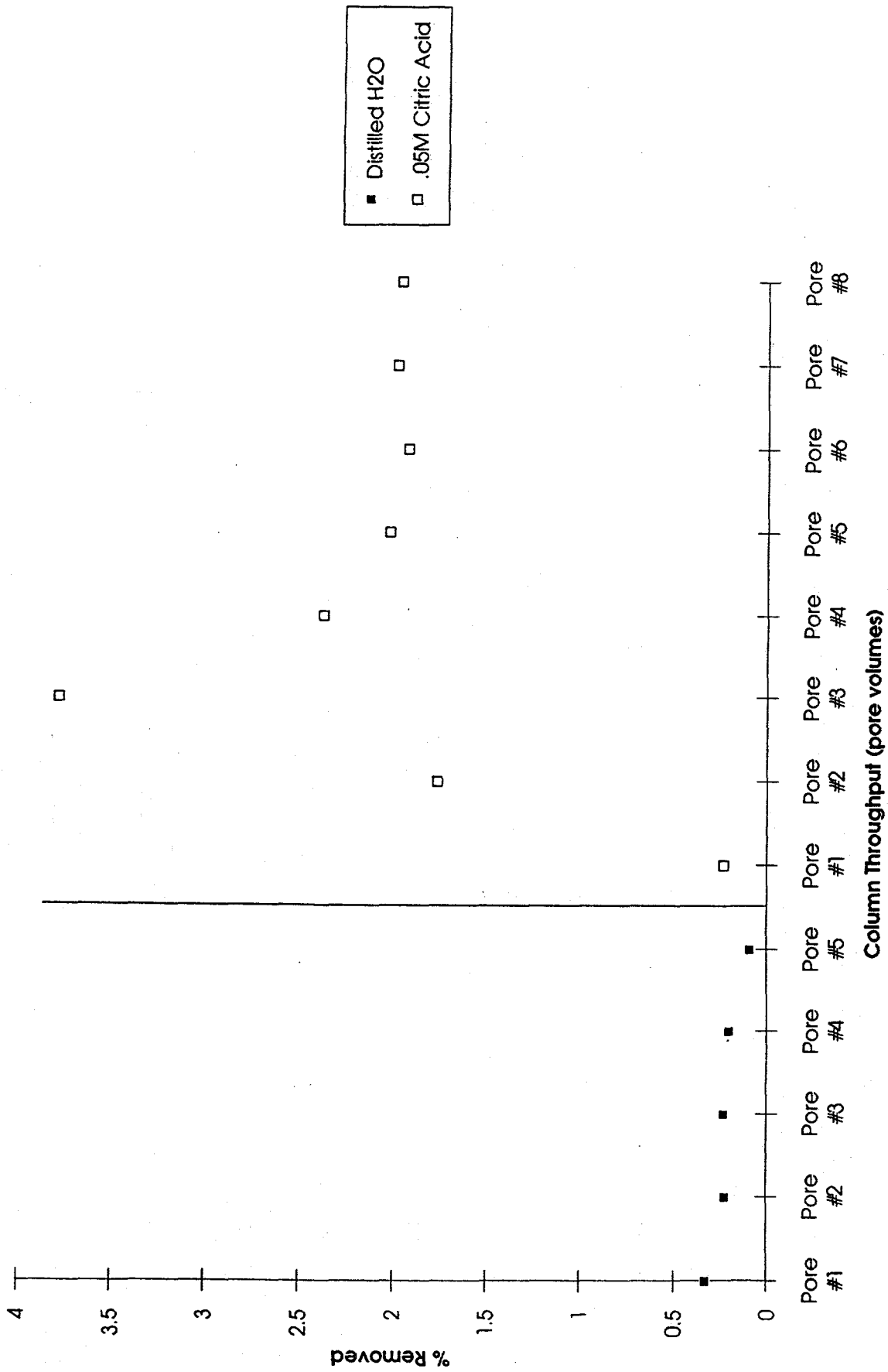


FIGURE 9 (Cont.)

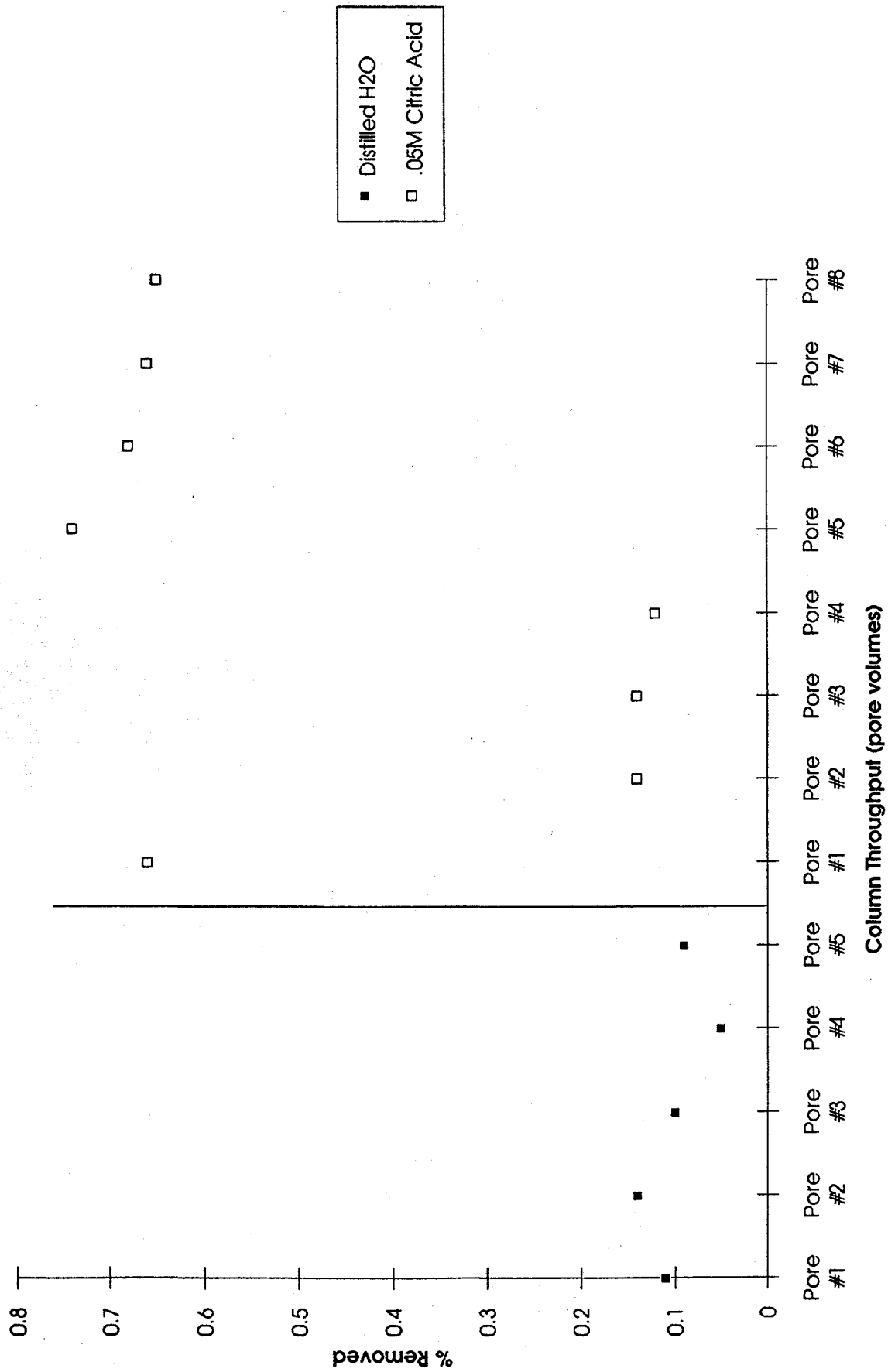


FIGURE 9 (Cont.)

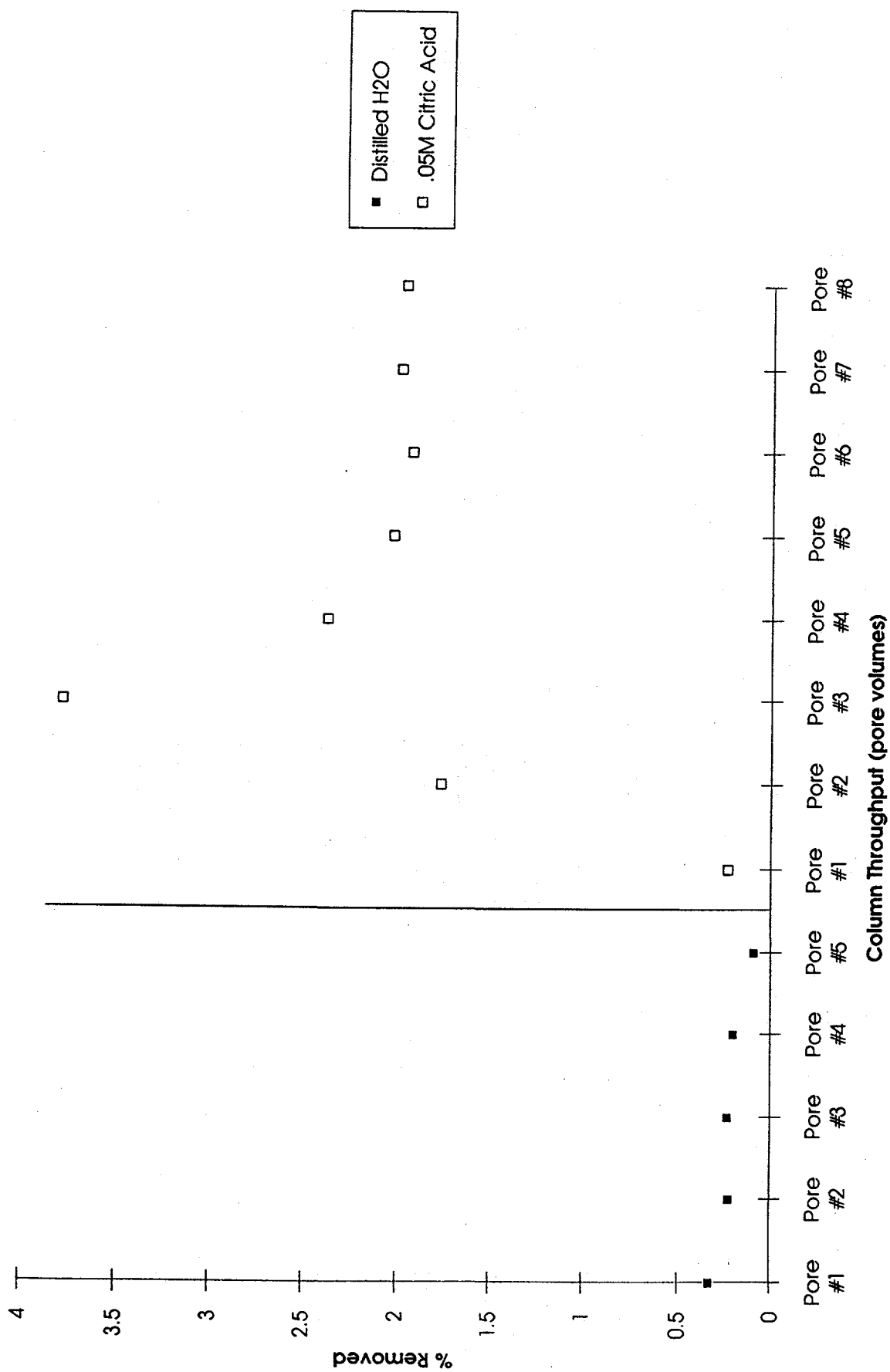


FIGURE 9 (Cont.)



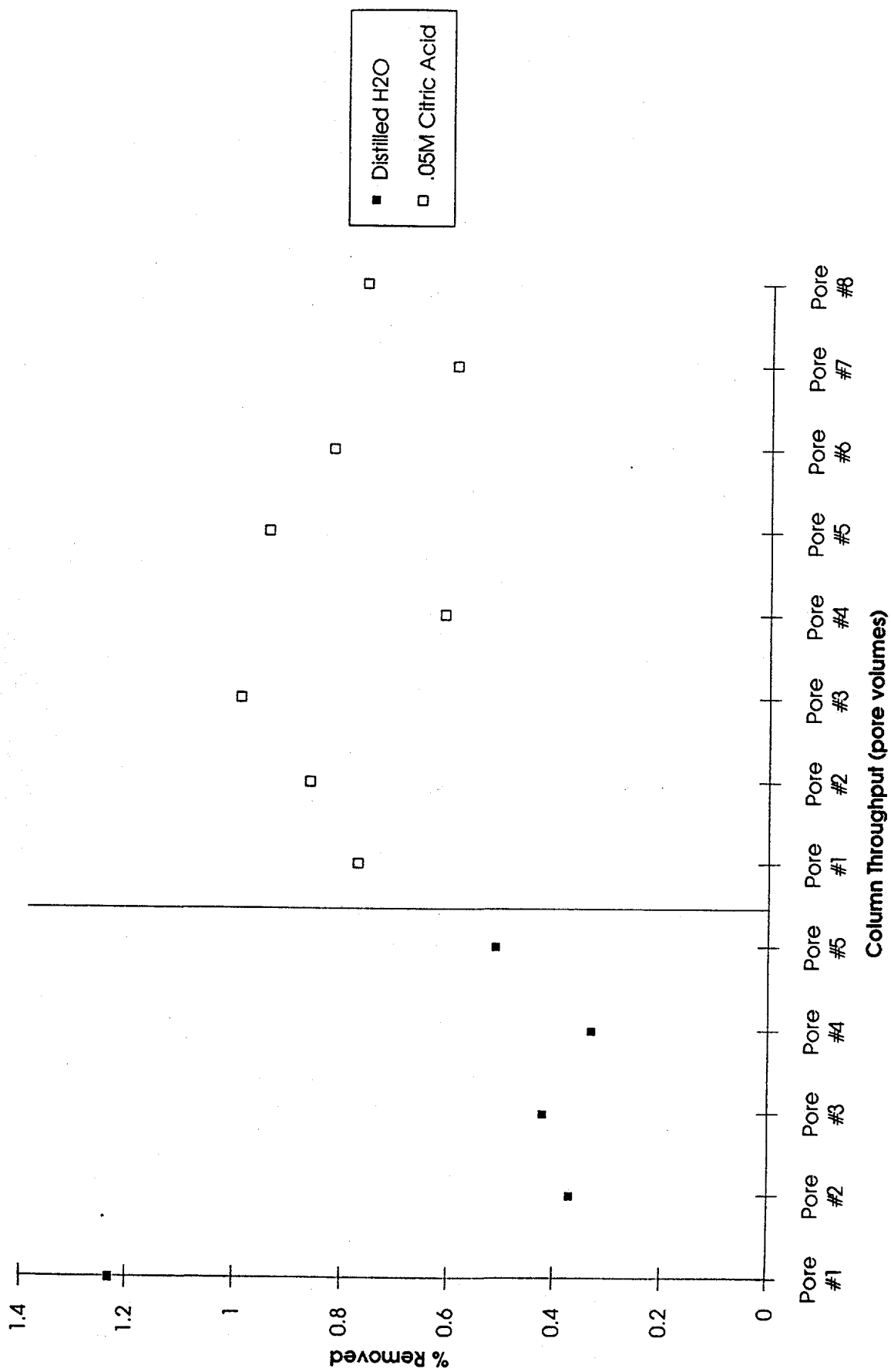


FIGURE 9 (Cont.)

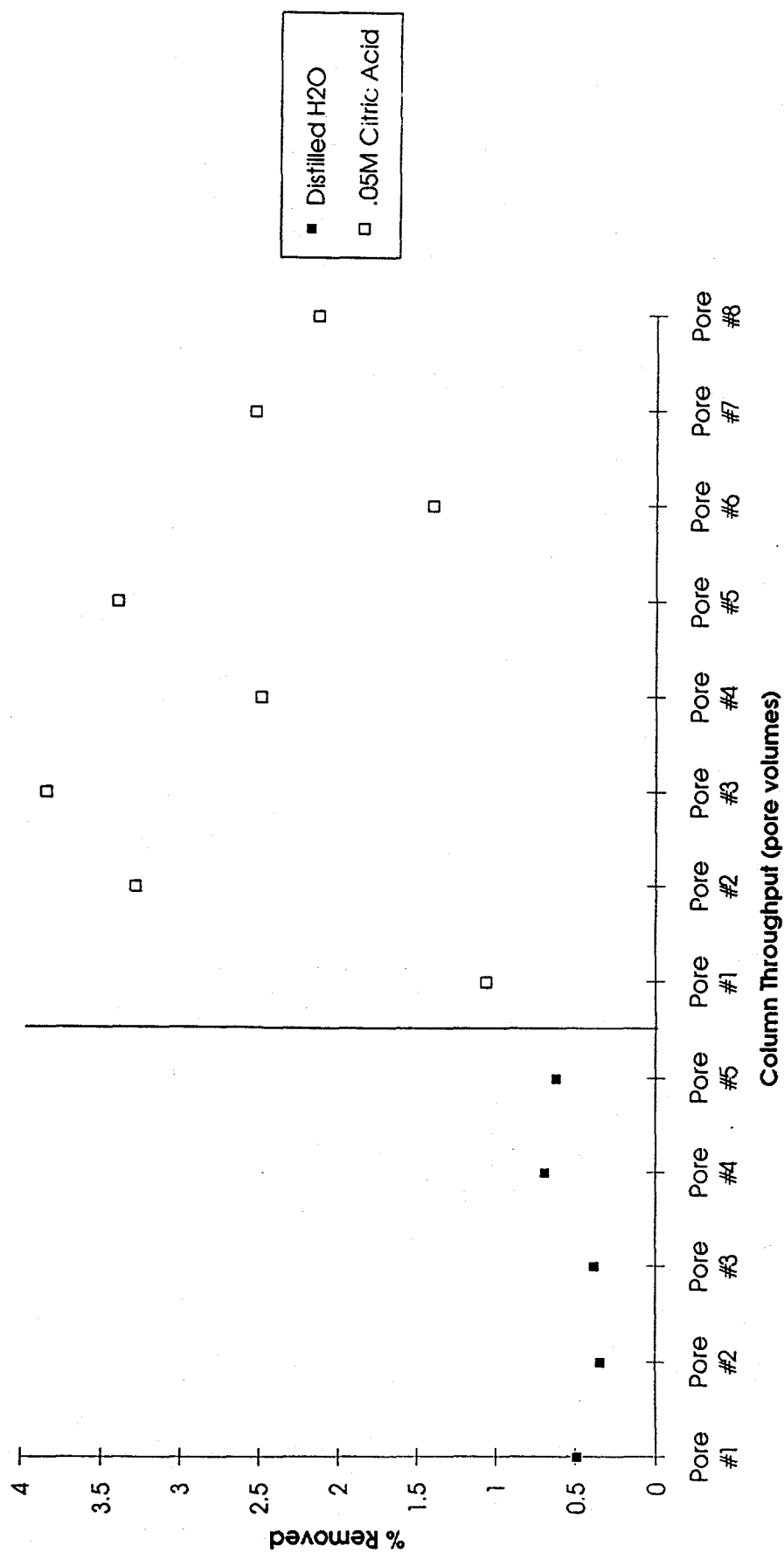


FIGURE 9 (Cont.)

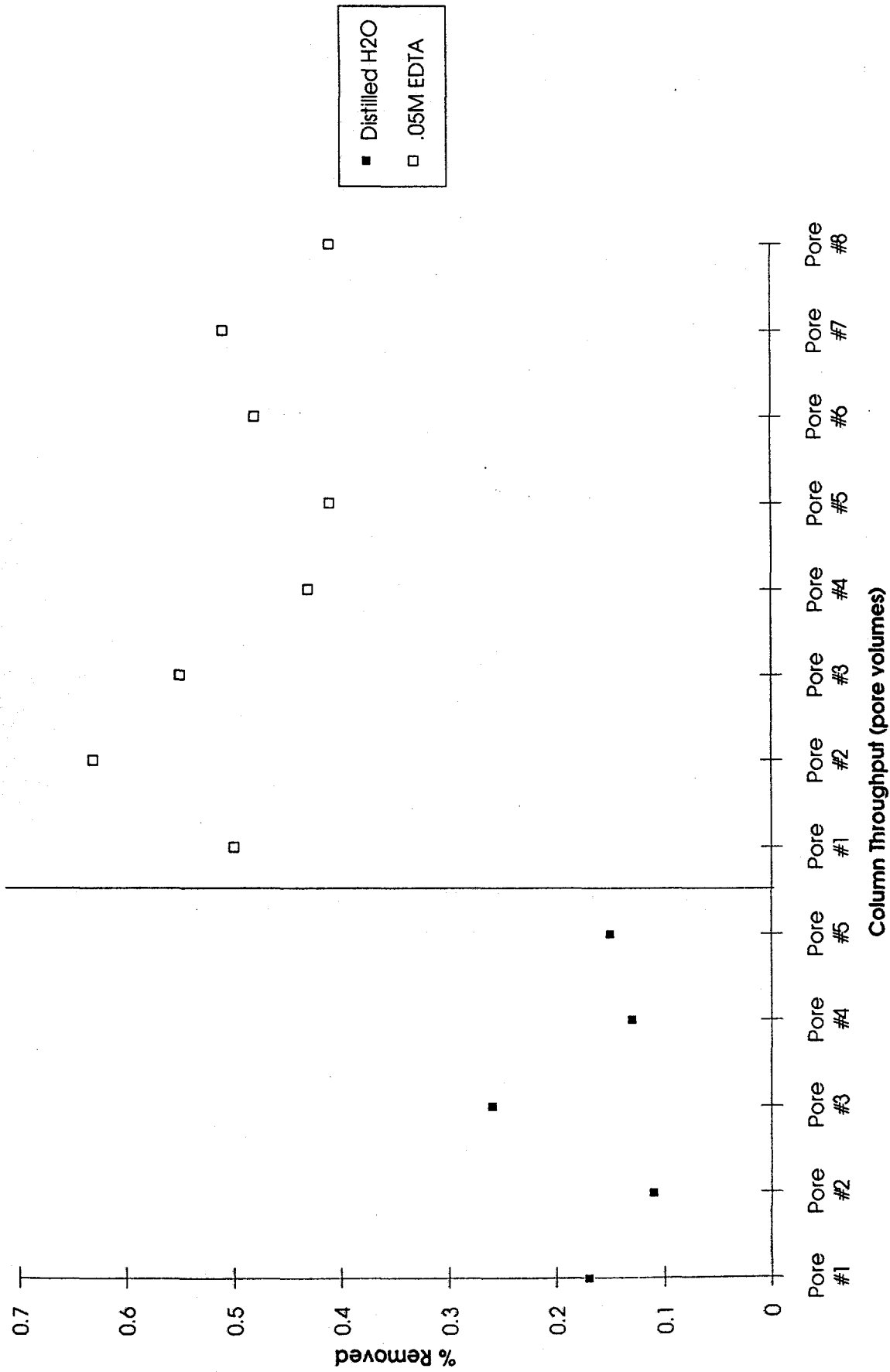


FIGURE 9 (Cont.)

## 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.

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

## Cd Removed by Batch Shaker Method

| SAMPLE #                 | Cd<br>(mg/kg) | Wt. of Soil<br>(g) | Cd in<br>Soil (mg) | Cd<br>(mg/L) | Cd in<br>Sample (mg) | % Cd<br>Removed | pH of<br>Sample | Cd Remaining<br>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%            | 3.257           | -0.067                          |
| 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<br>(mg/kg) | Wt. of Soil<br>(g) | Cd in<br>Soil (mg) | Cd<br>(mg/L) | Cd in<br>Sample (mg) | % Cd<br>Removed | pH of<br>Sample | Cd Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cd in<br>Soil (mg) | Cd<br>(mg/L) | Cd in<br>Sample (mg) | % Cd<br>Removed | pH of<br>Sample | Cd Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cd in<br>Soil (mg) | Cd<br>(mg/L) | Cd in<br>Sample (mg) | % Cd<br>Removed | pH of<br>Sample | Cd Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cr in<br>Soil (mg) | Cr<br>(mg/L) | Cr in<br>Sample (mg) | % Cr<br>Removed | pH of<br>Sample | Cr Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cr in<br>Soil (mg) | Cr<br>(mg/L) | Cr in<br>Sample (mg) | % Cr<br>Removed | pH of<br>Sample | Cr Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cr in<br>Soil (mg) | Cr<br>(mg/L) | Cr in<br>Sample (mg) | % Cr<br>Removed | pH of<br>Sample | Cr Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cr in<br>Soil (mg) | Cr<br>(mg/L) | Cr in<br>Sample (mg) | % Cr<br>Removed | pH of<br>Sample | Cr Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cr in<br>Soil (mg) | Cr<br>(mg/L) | Cr in<br>Sample (mg) | % Cr<br>Removed | pH of<br>Sample | Cr Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cu in<br>Soil (mg) | Cu<br>(mg/L) | Cu in<br>Sample (mg) | % Cu<br>Removed | pH of<br>Sample | Cu Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cu in<br>Soil (mg) | Cu<br>(mg/L) | Cu in<br>Sample (mg) | % Cu<br>Removed | pH of<br>Sample | Cu Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cu in<br>Soil (mg) | Cu<br>(mg/L) | Cu in<br>Sample (mg) | % Cu<br>Removed | pH of<br>Sample | Cu Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cu in<br>Soil (mg) | Cu<br>(mg/L) | Cu in<br>Sample (mg) | % Cu<br>Removed | pH of<br>Sample | Cu Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cu in<br>Soil (mg) | Cu<br>(mg/L) | Cu in<br>Sample (mg) | % Cu<br>Removed | pH of<br>Sample | Cu Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Fe in<br>Soil (mg) | Fe<br>(mg/L) | Fe in<br>Sample (mg) | % Fe<br>Removed | pH of<br>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<br>(mg/kg) | wt. of soil<br>(g) | mg Fe<br>in soil | Fe<br>(mg/L) | mg Fe<br>in sample | % Fe<br>removed | pH of<br>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<br>(mg/kg) | wt. of soil<br>(g) | mg Fe<br>in soil | Fe<br>(mg/L) | mg Fe<br>in sample | % Fe<br>removed | pH of<br>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<br>(mg/kg) | wt. of soil<br>(g) | mg Fe<br>in soil | Fe<br>(mg/L) | mg Fe<br>in sample | % Fe<br>removed | pH of<br>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<br>(mg/kg) | wt. of soil<br>(g) | mg Fe<br>in soil | Fe<br>(mg/L) | mg Fe<br>in sample | % Fe<br>removed | pH of<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pb in<br>Sample (mg) | % Pb<br>Removed | pH of<br>Sample | Pb Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pb in<br>Sample (mg) | % Pb<br>Removed | pH of<br>Sample | Pb Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pb in<br>Sample (mg) | % Pb<br>Removed | pH of<br>Sample | Pb Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pb in<br>Sample (mg) | % Pb<br>Removed | pH of<br>Sample | Pb Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pb in<br>Sample (mg) | % Pb<br>Removed | pH of<br>Sample | Pb Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Zn in<br>Soil (mg) | Zn<br>(mg/L) | Zn in<br>Sample (mg) | % Zn<br>Removed | pH of<br>Sample | Zn Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Zn in<br>Soil (mg) | Zn<br>(mg/L) | Zn in<br>Sample (mg) | % Zn<br>Removed | pH of<br>Sample | Zn Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Zn in<br>Soil (mg) | Zn<br>(mg/L) | Zn in<br>Sample (mg) | % Zn<br>Removed | pH of<br>Sample | Zn Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Zn in<br>Soil (mg) | Zn<br>(mg/L) | Zn in<br>Sample (mg) | % Zn<br>Removed | pH of<br>Sample | Zn Remaining<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Zn in<br>Soil (mg) | Zn<br>(mg/L) | Zn in<br>Sample (mg) | % Zn<br>Removed | pH of<br>Sample | Zn Remaining<br>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<br>of Sample | % Ba<br>Removed | % Cd<br>Removed | % Cr<br>Removed | % Cu<br>Removed | % Pb<br>Removed | % Zn<br>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<br>of Sample | % Ba<br>Removed | % Cd<br>Removed | % Cr<br>Removed | % Cu<br>Removed | % Pb<br>Removed | % Zn<br>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<br>of Sample | % Ba<br>Removed | % Cd<br>Removed | % Cr<br>Removed | % Cu<br>Removed | % Pb<br>Removed | % Zn<br>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<br>(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<br>of Sample | % Ba<br>Removed | % Cd<br>Removed | % Cr<br>Removed | % Cu<br>Removed | % Pb<br>Removed | % Zn<br>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<br>of Sample | % Ba<br>Removed | % Cd<br>Removed | % Cr<br>Removed | % Cu<br>Removed | % Pb<br>Removed | % Zn<br>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*<br>(of f/c samples) |                 | 59%             | 74%             | 109%            | 2243%           | 638%            | 74%             |
| 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          |  |        |       |       |       |        |        |
|                                   |  |        |       |       |       |        |        |
|                                   |  |        |       |       |       |        |        |
|                                   |  |        |       |       |       |        |        |
| 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<br>(mg/kg) | Wt. of Soil<br>(g) | Soil (mg) | Cd<br>(mg/L) | Pore Volume<br>(mL) | Cd in<br>Sample (mg) | % Cd<br>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. H20(5)    | 53.413        | 188.124            | 10.048    | 0.05         | 38.280              | 0.002                | 0.02%           |
| R111-2 Composite Pore#2 Dist. H20(5)    | 53.413        | 188.124            | 10.048    | 0.05         | 38.280              | 0.002                | 0.02%           |
| R111-2 Composite Pore#3 Dist. H20(5)    | 53.413        | 188.124            | 10.048    | 0.05         | 38.280              | 0.002                | 0.02%           |
| R111-2 Composite Pore#4 Dist. H20(5)    | 53.413        | 188.124            | 10.048    | 0.05         | 38.280              | 0.002                | 0.02%           |
| R111-2 Composite Pore#5 Dist. H20(5)    | 53.413        | 188.124            | 10.048    | 0.05         | 38.280              | 0.002                | 0.02%           |
| R111-2 Composite Drainage Dist. H20(5)  | 53.413        | 188.124            | 10.048    | 0.05         | 38.280              | 0.002                | 0.02%           |
| R111-2 Composite Composite Dist. H20(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. H20(5)    | 14.196        | 310.567            | 4.409     | 0.05         | 87.840              | 0.004                | 0.10%           |
| R111-3 Composite Pore#2 Dist. H20(5)    | 14.196        | 310.567            | 4.409     | 0.05         | 87.840              | 0.004                | 0.10%           |
| R111-3 Composite Pore#3 Dist. H20(5)    | 14.196        | 310.567            | 4.409     | 0.05         | 87.840              | 0.004                | 0.10%           |
| R111-3 Composite Pore#4 Dist. H20(5)    | 14.196        | 310.567            | 4.409     | 0.05         | 87.840              | 0.004                | 0.10%           |
| R111-3 Composite Pore#5 Dist. H20(5)    | 14.196        | 310.567            | 4.409     | 0.05         | 87.840              | 0.004                | 0.10%           |
| R111-3 Composite Drainage Dist. H20(5)  | 14.196        | 310.567            | 4.409     | 0.05         | 87.840              | 0.004                | 0.10%           |
| R111-3 Composite Composite Dist. H20(5) | 14.196        | 310.567            | 4.409     | 0.05         | 87.840              | 0.004                | 0.10%           |

## Cd Removed by Columnar Flooding

| SAMPLE                                   | Cd<br>(mg/kg) | Wt. of Soil<br>(g) | Cd in<br>Soil (mg) | Cd<br>(mg/L) | Pore Volume<br>(mL) | Cd in<br>Sample (mg) | % Cd<br>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              | 0.05         | 53.550              | 0.003                | 0.05%           |
| 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<br>(mg/kg) | Wt. of Soil<br>(g) | Cd in<br>Soil (mg) | Cd<br>(mg/L) | Pore Volume<br>(mL) | Cd in<br>Sample (mg) | % Cd<br>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 CompositeComposite 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<br>(mg/kg) | Wt. of Soil<br>(g) | Cd in<br>Soil (mg) | Cd<br>(mg/L) | Pore Volume<br>(mL) | Cd in  |      | % Cd<br>Removed |
|----------------------------------------|---------------|--------------------|--------------------|--------------|---------------------|--------|------|-----------------|
|                                        |               |                    |                    |              |                     | Sample | (mg) |                 |
| R124-2 CompositeComposite Dist. H20(5) | 0.476         | 312.744            | 0.149              | 0.05         | 46.880              | 0.002  |      | 1.58%           |
| R124-2 Composite Drainage Dist. H20(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. H20(5)   | 2.298         | 213.391            | 0.490              | 0.05         | 63.750              | 0.003  |      | 0.65%           |
| R124-3 Composite Pore#2 Dist. H20(5)   | 2.298         | 213.391            | 0.490              | 0.05         | 63.750              | 0.003  |      | 0.65%           |
| R124-3 Composite Pore#3 Dist. H20(5)   | 2.298         | 213.391            | 0.490              | 0.05         | 63.750              | 0.003  |      | 0.65%           |
| R124-3 Composite Pore#4 Dist. H20(5)   | 2.298         | 213.391            | 0.490              | 0.05         | 63.750              | 0.003  |      | 0.65%           |
| R124-3 Composite Pore#5 Dist. H20(5)   | 2.298         | 213.391            | 0.490              | 0.05         | 63.750              | 0.003  |      | 0.65%           |
| R124-3 CompositeComposite Dist. H20(5) | 2.298         | 213.391            | 0.490              | 0.05         | 63.750              | 0.003  |      | 0.65%           |
| R124-3 Composite Drainage Dist. H20(5) | 2.298         | 213.391            | 0.490              | 0.05         | 63.750              | 0.003  |      | 0.65%           |

## Cr Removed by Columnar Flooding

| SAMPLE                                  | Cr<br>(mg/kg) | Wt. of Soil<br>(g) | Cr in<br>Soil (mg) | Cr<br>(mg/L) | Pore Volume<br>(ml) | Cr in<br>Sample (mg) | % Cr<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cr in<br>Soil (mg) | Cr<br>(mg/L) | Pore Volume<br>(ml) | Cr in<br>Sample (mg) | % Cr<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cr in<br>Soil (mg) | Cr<br>(mg/L) | Pore Volume<br>(ml) | Cr in<br>Sample (mg) | % Cr<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cr in<br>Soil (mg) | Cr<br>(mg/L) | Pore Volume<br>(ml) | Cr in<br>Sample (mg) | % Cr<br>Removed |
|----------------------------------------|---------------|--------------------|--------------------|--------------|---------------------|----------------------|-----------------|
| R124-2 CompositeComposite Dist. H20(5) | 7.977         | 312.744            | 2.495              | 0.15         | 46.880              | 0.007                | 0.28%           |
| R124-2 Composite Drainage Dist. H20(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. H20(5)   | 6.788         | 213.391            | 1.448              | 0.15         | 63.750              | 0.010                | 0.66%           |
| R124-3 Composite Pore#2 Dist. H20(5)   | 6.788         | 213.391            | 1.448              | 0.15         | 63.750              | 0.010                | 0.66%           |
| R124-3 Composite Pore#3 Dist. H20(5)   | 6.788         | 213.391            | 1.448              | 0.15         | 63.750              | 0.010                | 0.66%           |
| R124-3 Composite Pore#4 Dist. H20(5)   | 6.788         | 213.391            | 1.448              | 0.15         | 63.750              | 0.010                | 0.66%           |
| R124-3 Composite Pore#5 Dist. H20(5)   | 6.788         | 213.391            | 1.448              | 0.15         | 63.750              | 0.010                | 0.66%           |
| R124-3 CompositeComposite Dist. H20(5) | 6.788         | 213.391            | 1.448              | 0.15         | 63.750              | 0.010                | 0.66%           |
| R124-3 Composite Drainage Dist. H20(5) | 6.788         | 213.391            | 1.448              | 0.15         | 63.750              | 0.010                | 0.66%           |

## Cu Removed by Columnar Flooding

| SAMPLE                                  | Cu<br>(mg/kg) | Wt. of Soil<br>(g) | Cu in<br>Soil (mg) | Cu<br>(mg/L) | Pore Volume<br>(ml) | Cu in<br>Sample (mg) | % Cu<br>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. H20(5)    | 392.773       | 188.124            | 73.890             | 0.79         | 38.280              | 0.030                | 0.04%           |
| R111-2 Composite Pore#2 Dist. H20(5)    | 392.773       | 188.124            | 73.890             | 0.72         | 38.280              | 0.028                | 0.04%           |
| R111-2 Composite Pore#3 Dist. H20(5)    | 392.773       | 188.124            | 73.890             | 0.87         | 38.280              | 0.033                | 0.05%           |
| R111-2 Composite Pore#4 Dist. H20(5)    | 392.773       | 188.124            | 73.890             | 0.72         | 38.280              | 0.028                | 0.04%           |
| R111-2 Composite Pore#5 Dist. H20(5)    | 392.773       | 188.124            | 73.890             | 0.39         | 38.280              | 0.015                | 0.02%           |
| R111-2 Composite Drainage Dist. H20(5)  | 392.773       | 188.124            | 73.890             | 0.38         | 38.280              | 0.015                | 0.02%           |
| R111-2 Composite Composite Dist. H20(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. H20(5)    | 335.786       | 310.567            | 104.284            | 0.42         | 87.840              | 0.037                | 0.04%           |
| R111-3 Composite Pore#2 Dist. H20(5)    | 335.786       | 310.567            | 104.284            | 0.41         | 87.840              | 0.036                | 0.03%           |
| R111-3 Composite Pore#3 Dist. H20(5)    | 335.786       | 310.567            | 104.284            | 0.39         | 87.840              | 0.034                | 0.03%           |
| R111-3 Composite Pore#4 Dist. H20(5)    | 335.786       | 310.567            | 104.284            | 0.51         | 87.840              | 0.045                | 0.04%           |
| R111-3 Composite Pore#5 Dist. H20(5)    | 335.786       | 310.567            | 104.284            | 0.34         | 87.840              | 0.030                | 0.03%           |
| R111-3 Composite Drainage Dist. H20(5)  | 335.786       | 310.567            | 104.284            | 0.28         | 87.840              | 0.025                | 0.02%           |
| R111-3 Composite Composite Dist. H20(5) | 335.786       | 310.567            | 104.284            | 0.38         | 87.840              | 0.033                | 0.03%           |

## Cu Removed by Columnar Flooding

| SAMPLE                                   | Cu      |        | Wt. of Soil<br>(g) | Cu in     |        | Pore Volume<br>(ml) | Cu in       |         | % Cu<br>Removed |
|------------------------------------------|---------|--------|--------------------|-----------|--------|---------------------|-------------|---------|-----------------|
|                                          | (mg/kg) | (mg/L) |                    | Soil (mg) | (mg/L) |                     | Sample (mg) | Removed |                 |
| R111-4 Composite Pore#1 .05M CIT(5)      | 258.584 | 7.86   | 206.100            | 53.294    | 7.86   | 53.550              | 0.421       | 0.79%   |                 |
| R111-4 Composite Pore#2 .05M CIT(5)      | 258.584 | 11.52  | 206.100            | 53.294    | 11.52  | 53.550              | 0.617       | 1.16%   |                 |
| R111-4 Composite Pore#3 .05M CIT(5)      | 258.584 | 11.46  | 206.100            | 53.294    | 11.46  | 53.550              | 0.614       | 1.15%   |                 |
| R111-4 Composite Pore#4 .05M CIT(5)      | 258.584 | 8.44   | 206.100            | 53.294    | 8.44   | 53.550              | 0.452       | 0.85%   |                 |
| R111-4 Composite Pore#5 .05M CIT(5)      | 258.584 | 6.9    | 206.100            | 53.294    | 6.9    | 53.550              | 0.369       | 0.69%   |                 |
| R111-4 Composite Pore#6 .05M CIT(5)      | 258.584 | 5.79   | 206.100            | 53.294    | 5.79   | 53.550              | 0.310       | 0.58%   |                 |
| R111-4 Composite Pore#7 .05M CIT(5)      | 258.584 | 5.27   | 206.100            | 53.294    | 5.27   | 53.550              | 0.282       | 0.53%   |                 |
| R111-4 Composite Pore#8 .05M CIT(5)      | 258.584 | 5.26   | 206.100            | 53.294    | 5.26   | 53.550              | 0.282       | 0.53%   |                 |
| R111-4 Composite Drainage .05M CIT(5)    | 258.584 | 13.73  | 206.100            | 53.294    | 13.73  | 53.550              | 0.735       | 1.38%   |                 |
| R111-4 Composite Composite .05M CIT(5)   | 258.584 | 8.81   | 206.100            | 53.294    | 8.81   | 53.550              | 0.472       | 0.89%   |                 |
| R111-4 Composite Pore#1 Dist. H20(5)     | 258.584 | 0.64   | 206.100            | 53.294    | 0.64   | 53.770              | 0.034       | 0.06%   |                 |
| R111-4 Composite Pore#2 Dist. H20(5)     | 258.584 | 0.75   | 206.100            | 53.294    | 0.75   | 53.770              | 0.040       | 0.08%   |                 |
| R111-4 Composite Pore#3 Dist. H20(5)     | 258.584 | 0.48   | 206.100            | 53.294    | 0.48   | 53.770              | 0.026       | 0.05%   |                 |
| R111-4 Composite Pore#4 Dist. H20(5)     | 258.584 | 0.38   | 206.100            | 53.294    | 0.38   | 53.770              | 0.020       | 0.04%   |                 |
| R111-4 Composite Pore#5 Dist. H20(5)     | 258.584 | 0.31   | 206.100            | 53.294    | 0.31   | 53.770              | 0.017       | 0.03%   |                 |
| R111-4 Composite Drainage Dist. H20(5)   | 258.584 | 0.31   | 206.100            | 53.294    | 0.31   | 53.770              | 0.017       | 0.03%   |                 |
| R111-4 Composite Composite Dist. H20(5)  | 258.584 | 0.4    | 206.100            | 53.294    | 0.4    | 53.770              | 0.022       | 0.04%   |                 |
| R111-4,3 Composite Pore#1 .05M CIT(5)    | 419.777 | 7.1    | 199.903            | 83.915    | 7.1    | 73.348              | 0.521       | 0.62%   |                 |
| R111-4,3 Composite Pore#2 .05M CIT(5)    | 419.777 | 34.45  | 199.903            | 83.915    | 34.45  | 73.348              | 2.527       | 3.01%   |                 |
| R111-4,3 Composite Pore#3 .05M CIT(5)    | 419.777 | 28.45  | 199.903            | 83.915    | 28.45  | 73.348              | 2.087       | 2.49%   |                 |
| R111-4,3 Composite Pore#4 .05M CIT(5)    | 419.777 | 21     | 199.903            | 83.915    | 21     | 73.348              | 1.540       | 1.84%   |                 |
| R111-4,3 Composite Pore#5 .05M CIT(5)    | 419.777 | 16.75  | 199.903            | 83.915    | 16.75  | 73.348              | 1.229       | 1.46%   |                 |
| R111-4,3 Composite Pore#6 .05M CIT(5)    | 419.777 | 13.17  | 199.903            | 83.915    | 13.17  | 73.348              | 0.966       | 1.15%   |                 |
| R111-4,3 Composite Pore#7 .05M CIT(5)    | 419.777 | 13.88  | 199.903            | 83.915    | 13.88  | 73.348              | 1.018       | 1.21%   |                 |
| R111-4,3 Composite Pore#8 .05M CIT(5)    | 419.777 | 16.22  | 199.903            | 83.915    | 16.22  | 73.348              | 1.190       | 1.42%   |                 |
| R111-4,3 Composite Drainage .05M CIT(5)  | 419.777 | 12.51  | 199.903            | 83.915    | 12.51  | 73.348              | 0.918       | 1.09%   |                 |
| R111-4,3 Composite Composite .05M CIT(5) | 419.777 | 19.05  | 199.903            | 83.915    | 19.05  | 73.348              | 1.397       | 1.67%   |                 |
| R111-4,3 Composite Pore#1 Dist. H20(5)   | 419.777 | 0.33   | 199.903            | 83.915    | 0.33   | 73.348              | 0.024       | 0.03%   |                 |
| R111-4,3 Composite Pore#2 Dist. H20(5)   | 419.777 | 0.5    | 199.903            | 83.915    | 0.5    | 73.348              | 0.037       | 0.04%   |                 |
| R111-4,3 Composite Pore#3 Dist. H20(5)   | 419.777 | 0.48   | 199.903            | 83.915    | 0.48   | 73.348              | 0.035       | 0.04%   |                 |
| R111-4,3 Composite Pore#4 Dist. H20(5)   | 419.777 | 0.4    | 199.903            | 83.915    | 0.4    | 73.348              | 0.029       | 0.03%   |                 |
| R111-4,3 Composite Pore#5 Dist. H20(5)   | 419.777 | 0.39   | 199.903            | 83.915    | 0.39   | 73.348              | 0.029       | 0.03%   |                 |
| R111-4,3 Composite Drainage Dist. H20(5) | 419.777 | 0.38   | 199.903            | 83.915    | 0.38   | 73.348              | 0.028       | 0.03%   |                 |

## Cu Removed by Columnar Flooding

| SAMPLE                                    | Cu<br>(mg/kg) | Wt. of Soil<br>(g) | Cu in<br>Soil (mg) | Cu<br>(mg/L) | Pore Volume<br>(ml) | Cu in<br>Sample (mg) | % Cu<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Cu in<br>Soil (mg) | Cu<br>(mg/L) | Pore Volume<br>(ml) | Cu in<br>Sample (mg) | % Cu<br>Removed |
|-----------------------------------------|---------------|--------------------|--------------------|--------------|---------------------|----------------------|-----------------|
|                                         |               |                    |                    |              |                     |                      |                 |
| R124-2 Composite Composite Dist. H20(5) | 518.894       | 312.744            | 162.281            | 0.56         | 46.880              | 0.026                | 0.02%           |
| R124-2 Composite Drainage Dist. H20(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. H20(5)    | 647.430       | 213.391            | 138.155            | 1.19         | 63.750              | 0.076                | 0.05%           |
| R124-3 Composite Pore#2 Dist. H20(5)    | 647.430       | 213.391            | 138.155            | 0.91         | 63.750              | 0.058                | 0.04%           |
| R124-3 Composite Pore#3 Dist. H20(5)    | 647.430       | 213.391            | 138.155            | 0.88         | 63.750              | 0.056                | 0.04%           |
| R124-3 Composite Pore#4 Dist. H20(5)    | 647.430       | 213.391            | 138.155            | 0.79         | 63.750              | 0.050                | 0.04%           |
| R124-3 Composite Pore#5 Dist. H20(5)    | 647.430       | 213.391            | 138.155            | 0.76         | 63.750              | 0.048                | 0.04%           |
| R124-3 Composite Composite Dist. H20(5) | 647.430       | 213.391            | 138.155            | 0.84         | 63.750              | 0.054                | 0.04%           |
| R124-3 Composite Drainage Dist. H20(5)  | 647.430       | 213.391            | 138.155            | 0.74         | 63.750              | 0.047                | 0.03%           |

## Fe Removed by Columnar Flooding

| SAMPLE                                  | Fe<br>(mg/kg) | Wt. of Soil<br>(g) | Fe in<br>Soil (mg) | Fe<br>(mg/L) | Pore Volume<br>(ml) | Fe in<br>Sample (mg) | % Fe<br>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. H20(5)    | 16852.850     | 188.124            | 3170.431           | 6.97         | 38.280              | 0.267                | 0.01%           |
| R111-2 Composite Pore#2 Dist. H20(5)    | 16852.850     | 188.124            | 3170.431           | 7.64         | 38.280              | 0.292                | 0.01%           |
| R111-2 Composite Pore#3 Dist. H20(5)    | 16852.850     | 188.124            | 3170.431           | 11.14        | 38.280              | 0.426                | 0.01%           |
| R111-2 Composite Pore#4 Dist. H20(5)    | 16852.850     | 188.124            | 3170.431           | 14.62        | 38.280              | 0.560                | 0.02%           |
| R111-2 Composite Pore#5 Dist. H20(5)    | 16852.850     | 188.124            | 3170.431           | 13.57        | 38.280              | 0.519                | 0.02%           |
| R111-2 Composite Drainage Dist. H20(5)  | 16852.850     | 188.124            | 3170.431           | 9.45         | 38.280              | 0.362                | 0.01%           |
| R111-2 Composite Composite Dist. H20(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. H20(5)    | 20954.455     | 310.567            | 6507.754           | 1.13         | 87.840              | 0.099                | 0.00%           |
| R111-3 Composite Pore#2 Dist. H20(5)    | 20954.455     | 310.567            | 6507.754           | 1.17         | 87.840              | 0.103                | 0.00%           |
| R111-3 Composite Pore#3 Dist. H20(5)    | 20954.455     | 310.567            | 6507.754           | 1.5          | 87.840              | 0.132                | 0.00%           |
| R111-3 Composite Pore#4 Dist. H20(5)    | 20954.455     | 310.567            | 6507.754           | 3.22         | 87.840              | 0.283                | 0.00%           |
| R111-3 Composite Pore#5 Dist. H20(5)    | 20954.455     | 310.567            | 6507.754           | 0.78         | 87.840              | 0.069                | 0.00%           |
| R111-3 Composite Drainage Dist. H20(5)  | 20954.455     | 310.567            | 6507.754           | 0.58         | 87.840              | 0.051                | 0.00%           |
| R111-3 Composite Composite Dist. H20(5) | 20954.455     | 310.567            | 6507.754           | 1.32         | 87.840              | 0.116                | 0.00%           |

## Fe Removed by Columnar Flooding

| SAMPLE                                   | Fe<br>(mg/kg) | Wt. of Soil<br>(g) | Fe in<br>Soil (mg) | Fe<br>(mg/L) | Pore Volume<br>(ml) | Fe in<br>Sample (mg) | % Fe<br>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. H20(5)     | 17551.639     | 206.100            | 3617.393           | 2.13         | 53.770              | 0.115                | 0.00%           |
| R111-4 Composite Pore#2 Dist. H20(5)     | 17551.639     | 206.100            | 3617.393           | 1.91         | 53.770              | 0.103                | 0.00%           |
| R111-4 Composite Pore#3 Dist. H20(5)     | 17551.639     | 206.100            | 3617.393           | 1.21         | 53.770              | 0.065                | 0.00%           |
| R111-4 Composite Pore#4 Dist. H20(5)     | 17551.639     | 206.100            | 3617.393           | 0.87         | 53.770              | 0.047                | 0.00%           |
| R111-4 Composite Pore#5 Dist. H20(5)     | 17551.639     | 206.100            | 3617.393           | 0.58         | 53.770              | 0.031                | 0.00%           |
| R111-4 Composite Drainage Dist. H20(5)   | 17551.639     | 206.100            | 3617.393           | 0.5          | 53.770              | 0.027                | 0.00%           |
| R111-4 Composite Composite Dist. H20(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. H20(5)   | 13675.318     | 199.903            | 2733.739           | 3.64         | 73.348              | 0.267                | 0.01%           |
| R111-4,3 Composite Pore#2 Dist. H20(5)   | 13675.318     | 199.903            | 2733.739           | 1.8          | 73.348              | 0.132                | 0.00%           |
| R111-4,3 Composite Pore#3 Dist. H20(5)   | 13675.318     | 199.903            | 2733.739           | 1.25         | 73.348              | 0.092                | 0.00%           |
| R111-4,3 Composite Pore#4 Dist. H20(5)   | 13675.318     | 199.903            | 2733.739           | 0.77         | 73.348              | 0.056                | 0.00%           |
| R111-4,3 Composite Pore#5 Dist. H20(5)   | 13675.318     | 199.903            | 2733.739           | 0.54         | 73.348              | 0.040                | 0.00%           |
| R111-4,3 Composite Drainage Dist. H20(5) | 13675.318     | 199.903            | 2733.739           | 1.12         | 73.348              | 0.082                | 0.00%           |

## Fe Removed by Columnar Flooding

| SAMPLE                                    | Fe<br>(mg/kg) | Wt. of Soil<br>(g) | Fe in<br>Soil (mg) | Fe<br>(mg/L) | Pore Volume<br>(ml) | Fe in<br>Sample (mg) | % Fe<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Fe in<br>Soil (mg) | Fe<br>(mg/L) | Pore Volume<br>(ml) | Fe in<br>Sample (mg) | % Fe<br>Removed |
|-----------------------------------------|---------------|--------------------|--------------------|--------------|---------------------|----------------------|-----------------|
| R124-2 Composite Composite Dist. H20(5) | 4225.295      | 312.744            | 1321.437           | 4.2          | 46.880              | 0.197                | 0.01%           |
| R124-2 Composite Drainage Dist. H20(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. H20(5)    | 3886.913      | 213.391            | 829.431            | 0.66         | 63.750              | 0.042                | 0.01%           |
| R124-3 Composite Pore#2 Dist. H20(5)    | 3886.913      | 213.391            | 829.431            | 0.5          | 63.750              | 0.032                | 0.00%           |
| R124-3 Composite Pore#3 Dist. H20(5)    | 3886.913      | 213.391            | 829.431            | 0.63         | 63.750              | 0.040                | 0.00%           |
| R124-3 Composite Pore#4 Dist. H20(5)    | 3886.913      | 213.391            | 829.431            | 0.5          | 63.750              | 0.032                | 0.00%           |
| R124-3 Composite Pore#5 Dist. H20(5)    | 3886.913      | 213.391            | 829.431            | 0.5          | 63.750              | 0.032                | 0.00%           |
| R124-3 Composite Composite Dist. H20(5) | 3886.913      | 213.391            | 829.431            | 0.5          | 63.750              | 0.032                | 0.00%           |
| R124-3 Composite Drainage Dist. H20(5)  | 3886.913      | 213.391            | 829.431            | 0.52         | 63.750              | 0.033                | 0.00%           |

## Pb Removed by Columnar Flooding

| SAMPLE                                        | Pb<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pore Volume<br>(ml) | Pb in<br>Sample (mg) | % Pb<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pore Volume<br>(ml) | Pb in<br>Sample (mg) | % Pb<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pore Volume<br>(ml) | Pb in<br>Sample (mg) | % Pb<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pore Volume<br>(ml) | Pb in<br>Sample (mg) | % Pb<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pore Volume<br>(ml) | Pb in<br>Sample (mg) | % Pb<br>Removed |
|------------------------------------------|---------------|--------------------|--------------------|--------------|---------------------|----------------------|-----------------|
| R111-3 Composite Pore#5 Dist. H20(5)     | 74.351        | 310.567            | 23.091             | 0.57         | 87.840              | 0.050                | 0.22%           |
| R111-3 Composite Drainage Dist. H20(5)   | 74.351        | 310.567            | 23.091             | 0.35         | 87.840              | 0.031                | 0.13%           |
| R111-3 Composite Composite Dist. H20(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. H20(5)     | 98.018        | 206.100            | 20.202             | 0.35         | 53.770              | 0.019                | 0.09%           |
| R111-4 Composite Pore#2 Dist. H20(5)     | 98.018        | 206.100            | 20.202             | 0.25         | 53.770              | 0.013                | 0.07%           |
| R111-4 Composite Pore#3 Dist. H20(5)     | 98.018        | 206.100            | 20.202             | 0.25         | 53.770              | 0.013                | 0.07%           |
| R111-4 Composite Pore#4 Dist. H20(5)     | 98.018        | 206.100            | 20.202             | 0.25         | 53.770              | 0.013                | 0.07%           |
| R111-4 Composite Pore#5 Dist. H20(5)     | 98.018        | 206.100            | 20.202             | 0.25         | 53.770              | 0.013                | 0.07%           |
| R111-4 Composite Drainage Dist. H20(5)   | 98.018        | 206.100            | 20.202             | 0.25         | 53.770              | 0.013                | 0.07%           |
| R111-4 Composite Composite Dist. H20(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. H20(5)   | 137.333       | 199.903            | 27.453             | 0.25         | 73.348              | 0.018                | 0.07%           |
| R111-4,3 Composite Pore#2 Dist. H20(5)   | 137.333       | 199.903            | 27.453             | 0.25         | 73.348              | 0.018                | 0.07%           |
| R111-4,3 Composite Pore#3 Dist. H20(5)   | 137.333       | 199.903            | 27.453             | 0.25         | 73.348              | 0.018                | 0.07%           |

## Pb Removed by Columnar Flooding

| SAMPLE                                    | Pb<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pore Volume<br>(ml) | Pb in<br>Sample (mg) | % Pb<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pore Volume<br>(ml) | Pb in<br>Sample (mg) | % Pb<br>Removed |
|-----------------------------------------|---------------|--------------------|--------------------|--------------|---------------------|----------------------|-----------------|
| R124 Composite Pore#3 Dist. H20(5)      | 8106.044      | 342.551            | 2776.730           | 3.20         | 55.770              | 0.178                | 0.01%           |
| R124 Composite Pore#4 Dist. H20(5)      | 8106.044      | 342.551            | 2776.730           | 2.30         | 55.770              | 0.128                | 0.00%           |
| R124 Composite Pore#5 Dist. H20(5)      | 8106.044      | 342.551            | 2776.730           | 2.22         | 55.770              | 0.124                | 0.00%           |
| R124 Composite Composite Dist. H20(5)   | 8106.044      | 342.551            | 2776.730           | 3.07         | 55.770              | 0.171                | 0.01%           |
| R124 Composite Drainage Dist. H20(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. H20(5)    | 8155.602      | 312.744            | 2550.618           | 14.36        | 46.880              | 0.673                | 0.03%           |
| R124-2 Composite Pore#2 Dist. H20(5)    | 8155.602      | 312.744            | 2550.618           | 10.83        | 46.880              | 0.508                | 0.02%           |
| R124-2 Composite Pore#3 Dist. H20(5)    | 8155.602      | 312.744            | 2550.618           | 4.70         | 46.880              | 0.220                | 0.01%           |
| R124-2 Composite Pore#4 Dist. H20(5)    | 8155.602      | 312.744            | 2550.618           | 3.45         | 46.880              | 0.162                | 0.01%           |
| R124-2 Composite Pore#5 Dist. H20(5)    | 8155.602      | 312.744            | 2550.618           | 4.15         | 46.880              | 0.195                | 0.01%           |
| R124-2 Composite Composite Dist. H20(5) | 8155.602      | 312.744            | 2550.618           | 5.24         | 46.880              | 0.246                | 0.01%           |
| R124-2 Composite Drainage Dist. H20(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. H20(5)    | 28129.324     | 213.391            | 6002.539           | 1.59         | 63.750              | 0.101                | 0.00%           |

### Pb Removed by Columnar Flooding

| SAMPLE                                  | Pb<br>(mg/kg) | Wt. of Soil<br>(g) | Pb in<br>Soil (mg) | Pb<br>(mg/L) | Pore Volume<br>(ml) | Pb in<br>Sample (mg) | % Pb<br>Removed |
|-----------------------------------------|---------------|--------------------|--------------------|--------------|---------------------|----------------------|-----------------|
| R124-3 Composite Pore#2 Dist. H20(5)    | 28129.324     | 213.391            | 6002.539           | 0.83         | 63.750              | 0.053                | 0.00%           |
| R124-3 Composite Pore#3 Dist. H20(5)    | 28129.324     | 213.391            | 6002.539           | 1.80         | 63.750              | 0.115                | 0.00%           |
| R124-3 Composite Pore#4 Dist. H20(5)    | 28129.324     | 213.391            | 6002.539           | 0.94         | 63.750              | 0.060                | 0.00%           |
| R124-3 Composite Pore#5 Dist. H20(5)    | 28129.324     | 213.391            | 6002.539           | 3.67         | 63.750              | 0.234                | 0.00%           |
| R124-3 Composite Composite Dist. H20(5) | 28129.324     | 213.391            | 6002.539           | 0.83         | 63.750              | 0.053                | 0.00%           |
| R124-3 Composite Drainage Dist. H20(5)  | 28129.324     | 213.391            | 6002.539           | 1.16         | 63.750              | 0.074                | 0.00%           |

## Zn Removed by Columnar Flooding

| SAMPLE                                  | Zn<br>(mg/kg) | Wt. of Soil<br>(g) | Zn in<br>Soil (mg) | Zn<br>(mg/L) | Pore Volume<br>(ml) | Zn in<br>Sample (mg) | % Zn<br>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       |        | Wt. of Soil<br>(g) | Zn in     |        | Pore Volume<br>(ml) | Zn in       |         | % Zn<br>Removed |
|------------------------------------------|----------|--------|--------------------|-----------|--------|---------------------|-------------|---------|-----------------|
|                                          | (mg/kg)  | (mg/L) |                    | Soil (mg) | (mg/L) |                     | Sample (mg) | Removed |                 |
| R111-4 Composite Pore#1 .05M CIT(5)      | 1697.747 | 43.12  | 206.100            | 349.906   | 43.12  | 53.550              | 2.309       | 0.66%   |                 |
| R111-4 Composite Pore#2 .05M CIT(5)      | 1697.747 | 9.01   | 206.100            | 349.906   | 9.01   | 53.550              | 0.482       | 0.14%   |                 |
| R111-4 Composite Pore#3 .05M CIT(5)      | 1697.747 | 9.29   | 206.100            | 349.906   | 9.29   | 53.550              | 0.497       | 0.14%   |                 |
| R111-4 Composite Pore#4 .05M CIT(5)      | 1697.747 | 7.72   | 206.100            | 349.906   | 7.72   | 53.550              | 0.413       | 0.12%   |                 |
| R111-4 Composite Pore#5 .05M CIT(5)      | 1697.747 | 48.26  | 206.100            | 349.906   | 48.26  | 53.550              | 2.584       | 0.74%   |                 |
| R111-4 Composite Pore#6 .05M CIT(5)      | 1697.747 | 44.61  | 206.100            | 349.906   | 44.61  | 53.550              | 2.389       | 0.68%   |                 |
| R111-4 Composite Pore#7 .05M CIT(5)      | 1697.747 | 42.98  | 206.100            | 349.906   | 42.98  | 53.550              | 2.302       | 0.66%   |                 |
| R111-4 Composite Pore#8 .05M CIT(5)      | 1697.747 | 42.15  | 206.100            | 349.906   | 42.15  | 53.550              | 2.257       | 0.65%   |                 |
| R111-4 Composite Drainage .05M CIT(5)    | 1697.747 | 47.21  | 206.100            | 349.906   | 47.21  | 53.550              | 2.528       | 0.72%   |                 |
| R111-4 Composite Composite .05M CIT(5)   | 1697.747 | 74.58  | 206.100            | 349.906   | 74.58  | 53.550              | 3.994       | 1.14%   |                 |
| R111-4 Composite Pore#1 Dist. H20(5)     | 1697.747 | 7.25   | 206.100            | 349.906   | 7.25   | 53.770              | 0.390       | 0.11%   |                 |
| R111-4 Composite Pore#2 Dist. H20(5)     | 1697.747 | 9.06   | 206.100            | 349.906   | 9.06   | 53.770              | 0.487       | 0.14%   |                 |
| R111-4 Composite Pore#3 Dist. H20(5)     | 1697.747 | 6.50   | 206.100            | 349.906   | 6.50   | 53.770              | 0.350       | 0.10%   |                 |
| R111-4 Composite Pore#4 Dist. H20(5)     | 1697.747 | 3.22   | 206.100            | 349.906   | 3.22   | 53.770              | 0.173       | 0.05%   |                 |
| R111-4 Composite Pore#5 Dist. H20(5)     | 1697.747 | 5.57   | 206.100            | 349.906   | 5.57   | 53.770              | 0.299       | 0.09%   |                 |
| R111-4 Composite Drainage Dist. H20(5)   | 1697.747 | 4.43   | 206.100            | 349.906   | 4.43   | 53.770              | 0.238       | 0.07%   |                 |
| R111-4 Composite Composite Dist. H20(5)  | 1697.747 | 7.48   | 206.100            | 349.906   | 7.48   | 53.770              | 0.402       | 0.11%   |                 |
| R111-4,3 Composite Pore#1 .05M CIT(5)    | 757.267  | 4.71   | 199.903            | 151.380   | 4.71   | 73.348              | 0.345       | 0.23%   |                 |
| R111-4,3 Composite Pore#2 .05M CIT(5)    | 757.267  | 36.33  | 199.903            | 151.380   | 36.33  | 73.348              | 2.665       | 1.76%   |                 |
| R111-4,3 Composite Pore#3 .05M CIT(5)    | 757.267  | 78.08  | 199.903            | 151.380   | 78.08  | 73.348              | 5.727       | 3.78%   |                 |
| R111-4,3 Composite Pore#4 .05M CIT(5)    | 757.267  | 48.86  | 199.903            | 151.380   | 48.86  | 73.348              | 3.584       | 2.37%   |                 |
| R111-4,3 Composite Pore#5 .05M CIT(5)    | 757.267  | 41.71  | 199.903            | 151.380   | 41.71  | 73.348              | 3.059       | 2.02%   |                 |
| R111-4,3 Composite Pore#6 .05M CIT(5)    | 757.267  | 39.69  | 199.903            | 151.380   | 39.69  | 73.348              | 2.911       | 1.92%   |                 |
| R111-4,3 Composite Pore#7 .05M CIT(5)    | 757.267  | 40.83  | 199.903            | 151.380   | 40.83  | 73.348              | 2.995       | 1.98%   |                 |
| R111-4,3 Composite Pore#8 .05M CIT(5)    | 757.267  | 40.36  | 199.903            | 151.380   | 40.36  | 73.348              | 2.960       | 1.96%   |                 |
| R111-4,3 Composite Drainage .05M CIT(5)  | 757.267  | 37.37  | 199.903            | 151.380   | 37.37  | 73.348              | 2.741       | 1.81%   |                 |
| R111-4,3 Composite Composite .05M CIT(5) | 757.267  | 39.14  | 199.903            | 151.380   | 39.14  | 73.348              | 2.871       | 1.90%   |                 |
| R111-4,3 Composite Pore#1 Dist. H20(5)   | 757.267  | 6.77   | 199.903            | 151.380   | 6.77   | 73.348              | 0.497       | 0.33%   |                 |
| R111-4,3 Composite Pore#2 Dist. H20(5)   | 757.267  | 4.64   | 199.903            | 151.380   | 4.64   | 73.348              | 0.340       | 0.22%   |                 |
| R111-4,3 Composite Pore#3 Dist. H20(5)   | 757.267  | 4.78   | 199.903            | 151.380   | 4.78   | 73.348              | 0.351       | 0.23%   |                 |
| R111-4,3 Composite Pore#4 Dist. H20(5)   | 757.267  | 4.18   | 199.903            | 151.380   | 4.18   | 73.348              | 0.307       | 0.20%   |                 |
| R111-4,3 Composite Pore#5 Dist. H20(5)   | 757.267  | 1.77   | 199.903            | 151.380   | 1.77   | 73.348              | 0.130       | 0.09%   |                 |
| R111-4,3 Composite Drainage Dist. H20(5) | 757.267  | 4.96   | 199.903            | 151.380   | 4.96   | 73.348              | 0.364       | 0.24%   |                 |

## Zn Removed by Columnar Flooding

| SAMPLE                                    | Zn<br>(mg/kg) | Wt. of Soil<br>(g) | Zn in<br>Soil (mg) | Zn<br>(mg/L) | Pore Volume<br>(ml) | Zn in<br>Sample (mg) | % Zn<br>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<br>(mg/kg) | Wt. of Soil<br>(g) | Zn In<br>Soil (mg) | Zn<br>(mg/L) | Pore Volume<br>(ml) | Zn in<br>Sample (mg) | % Zn<br>Removed |
|-----------------------------------------|---------------|--------------------|--------------------|--------------|---------------------|----------------------|-----------------|
| R124-2 Composite Composite Dist. H20(5) | 146.954       | 312.744            | 45.959             | 3.54         | 46.880              | 0.166                | 0.36%           |
| R124-2 Composite Drainage Dist. H20(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. H20(5)    | 140.024       | 213.391            | 29.880             | 2.31         | 63.750              | 0.147                | 0.49%           |
| R124-3 Composite Pore#2 Dist. H20(5)    | 140.024       | 213.391            | 29.880             | 1.58         | 63.750              | 0.101                | 0.34%           |
| R124-3 Composite Pore#3 Dist. H20(5)    | 140.024       | 213.391            | 29.880             | 1.77         | 63.750              | 0.113                | 0.38%           |
| R124-3 Composite Pore#4 Dist. H20(5)    | 140.024       | 213.391            | 29.880             | 3.22         | 63.750              | 0.205                | 0.69%           |
| R124-3 Composite Pore#5 Dist. H20(5)    | 140.024       | 213.391            | 29.880             | 2.91         | 63.750              | 0.186                | 0.62%           |
| R124-3 Composite Composite Dist. H20(5) | 140.024       | 213.391            | 29.880             | 1.62         | 63.750              | 0.103                | 0.35%           |
| R124-3 Composite Drainage Dist. H20(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**















