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EVALUATION OF SOLIDIFICATION/STABILIZATION FOR TREATING CONTAMINATED SOILS FROM THE FRONTIER HARD CHROME SITE

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by

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13. ABSTRACT (Maximum 200 word)

Solidification/stabilization (S/S) of chromium in contaminated soils has proven to be one of the more intractable problems in applying S/S technology. This is particularly true when attempting to reduce the mobility of the chromium VI ion. The evaluation problem is compounded by the availability of numerous "proprietary" S/S mixes. This paper describes a study in which eight formulations were evaluated for their ability to reduce the mobility of chromium III and chromium VI.

The physical and contaminant release properties of a generic formulation and formulations provided by seven vendors were evaluated in a rigidly controlled study conducted at the US Army Engineer Waterways Experiment Station. The suite of physical tests included unconfined compressive strength, wet/dry durability, permeability, moisture content, Atterberg limits, Proctor density, bulk density, specific gravity, slump, cracking, blued water, and resistance to penetration.

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The Toxicity Characteristic Leaching Procedure (TCLP) and the first extraction of the Monofilled Waste Extraction Procedure (MWEP-1) were used to evaluate contaminant release and were performed by Radian, Inc.

In general, all vendor formulations and the generic formulation resulted in significant improvements in the physical strength and durability properties of the soil.

The results of contaminant release testing were less encouraging. Neither the generic formulation nor the vendor-supplied formulations produced a product capable of meeting the stringent 0.05-mg/L goal set for the MWEP-1. All formulations satisfied the TCLP goal of 5.0 mg/L. However, several formulations appeared to increase the mobility of chromium.

14. (Concluded).

Chromium
Hexavalent chromium
MWEP
Permeability
Solidification

Stabilization TCLP UCS Wet/dry

PREFACE

The work reported herein was conducted for the US Army Engineer District, Kansas City (CEMRK), and the US Environmental Protection Agency (USEPA), Region X, by the US Army Engineer Waterways Experiment Station (WES) under Intra-Army Order No. KC-89-116. Mr. Bill McFarland was the Project Manager for CEMRK. Mr. Bill Adams was the Project Manager for the USEPA. This study was conducted as a bench-scale evaluation of the feasibility of using chemical solidification/stabilization for treating contaminated soils from the Frontier Hard Chrome site in Vancouver, WA.

The report was prepared by Ms. Elizabeth C. Fleming and Dr. M. John Cullinane, Jr., of the Water Supply and Waste Treatment Group (WSWTG), Environmental Engineering Division (EED), Environmental Laboratory (EL), WES. Waste extractions and chemical analyses were performed by Radian, Inc.

The study was conducted under the direct supervision of Mr. Norman R. Francingues, Chief, WSWTG, and under the general supervision of Dr. Raymond L. Montgomery, Chief, EED, and Dr. John Harrison, Director, EL.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander and Deputy Director was COL Leonard G. Hassell, EN.

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LIST OF ACRONYMS

ACCRML Average Cumulative, Corrected Relative Mass Loss

ANOVA Analysis of Variance
ASR Additive to Soil Ratio

ASTM American Society for Testing Materials

BFS Blast furnace slag

CERCLA Comprehensive Environmental Response Compensation and

Liability Act

CI Cone Index Test
CRS Chrome Reduction Study
FHC Frontier Hard Chrome

MWEP Monofilled Waste Extraction Procedure
NMLC Normalized mass leached concentration
MNMCSL Mean normalized mass chromium (VI) leached
MNMTCL Mean normalized mass total chromium leached

NPL National Priority List

QA/QC Quality Assurance/Quality Control

ROD Record of Decision

RSD Relative standard deviation S/S Solidification/Stabilization

TCLP Toxicity Characteristic Leaching Procedure

UCS Unconfined Compressive Strength
WDOE Washington Department of Ecology

WSR Water-to-Soil Ratio

CONVERSION FACTORS, NON-SI TO SI UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI units as follows:

Multiply	Ву	To Obtain
acres	4,046.873	square meters
cubic feet	0.02831685	cubic meters
degrees (angle)	0.01745329	radians
Fahrenheit degrees	5/9	Celsius degrees or kelvins*
feet	0.3048	meters
gallons (US liquid)	3.785412	liters
inches	2.54	centimeters
miles (US statute)	1.609347	kilometers
pounds (force) per square inch	6.894757	kilopascals
pounds (mass)	0.4535924	kilograms
pounds (mass) per cubic foot	16.01846	kilograms per cubic meter
quarts (US liquid)	0.9463529	liters
square inches	6.4516	square centimeters

^{*} To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: C = (5/9)(F - 32). To obtain Kelvin (K) readings, use: K = (5/9)(F - 32) + 273.15.

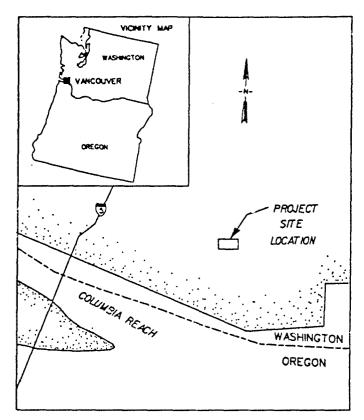


Figure 1. Location of Frontier Hard Chrome site

AN EVALUATION OF SOLIDIFICATION/STABILIZATION FOR TREATING CONTAMINATED SOILS FROM THE FRONTIER HARD CHROME SITE

PART I: INTRODUCTION

Background

- 1. Frontier Hard Chrome (FHC) site is an inactive industrial facility located at 113 Y Street, Vancouver, Clark County, Washington. Figure 1 shows the general location of the 0.5-acre* site, which is bordered to the east by Grand Avenue, to the south by Richardson Metal Works, and to the west by Y Street. Contamination of the site is the result of industrial chrome-plating operations conducted for a period of 25 years. From 1958 to 1983, the site was used for metal-plating operations for several metal fabricators in the Vancouver area. After that time, the FHC facility and the surrounding area were leased to neighboring businesses.
- 2. From 1958 to 1970 the site was used by Pioneer Plating, and from 1970 until 1983 it was used by FHC. During FHC operations, effluent from the facility was discharged to the sanitary sewer system. In 1975, the Washington Department of Ecology (WDOE) halted further discharges into the sewer system and required FHC to install a pretreatment system for chromium. At that point, FHC began discharging the effluent into the dry well located behind the FHC building.
- 3. In 1976, FHC was issued a wastewater treatment permit by WDOE to discharge waters to the dry well; the permit included a plan for chromium treatment systems to be installed. However, FHC did not install a treatment system and continued to discharge wastewaters to the dry well.
- 4. In 1982, after extensions of the deadline for installation of the treatment system had passed, it was found that an industrial supply well 0.25 mile southwest of the FHC site was contaminated with chromium at levels above the drinking water standard of 0.05 mg/L. The WDOE granted FHC a new deadline for compliance with the wastewater treatment permit requirements. FHC again failed to meet the deadline for installation of a treatment system. In 1983, the FHC site was placed on the National Priority List (NPL) under the

^{*} A table of factors for converting non-SI units of measurement to SI units is presented on page 7.

Comprehensive Environmental Response Compensation and Liability ACT (CERCLA). Industrial operations at the FHC site ceased.

- 5. The USEPA authorized the WDOE to begin investigating the cleanup of the FHC site under the Superfund progrew. In 1987, WDOE contracted with Dames & Moore to conduct a feasibility study for remediation of the FHC site. In 1987, a Record of Decision (ROD) was issued concerning soil contamination at the site. In March 1988, the US Environmental Protection Agency (USEPA) regained the lead control of cleanup investigations at the FHC site and contracted with the US Army Engineer District, Kansas City (CEMRK), to aid in the investigation.
- 6. The contamination of the site is divided into two units: a soils unit and a groundwater unit. The soils unit is subdivided into two types of material, a fill and a clay. Primary contaminants of interest are chromium (VI) and chromium (III). Contamination at depths up to 16 ft has been identified. Table 1 lists the major soil contaminants found at the FHC site, as documented in the remedial investigation conducted by the WDOE in the fall of 1984.

Solidification/Stabilization

Description

7. Solidification/stabilization (S/S) is a process that involves the mixing of a contaminated soil with a binder material to enhance the physical and chemical properties of the soil and to chemically bind any free liquid (USEPA 1986b). Typically, the binder is a cement, pozzolan, or thermoplastic. Proprietary additives may also be added. In most cases, the S/S process is changed to accommodate specific contaminants and soil matrices. Since it is not possible to discuss all possible modifications to a S/S process, discussions of most S/S processes have to be related directly to generic process types. The performance observed for a specific S/S system may vary widely from its generic type, but the general characteristics of a process and its products are usually similar. Comprehensive general discussions of waste S/S processes are given in Malone and Jones (1979), Malone, Jones, and Larson (1980), and USEPA (1986c).

Table 1

Concentration of Chromium in FHC Soils in Analysis Conducted
in the RI

Soil Sample Designation	Depth ft	Total Cr. ppm	Cr(VI)	% Cr(VI)
B85-2	0-1.5	40		1
D03-2			0.5	ı.
	5-6.5	15	<0.5	6
	10-10.5	90	5	О
	15-16.5	44	NA 110	20
	20-21(b)	340	110	32
	20-21(b)	350	88	25
	25-25.3	110	18	16
	29-29.8	46	4.0	9
	33.5-33.8	34	NA	
B85-3	0-1.5	1,400	41	3
	5-6.5	970	16	2
	10-10.5	150	5.5	4
	15-16.5(b)	25	<0.5	
	15-16.5(b)	31	<0.5	
	20-21.5(Ъ)	230	<0.5	
	20-21.5(b)	160	<0.5	
	25-25.5	65	<0.5	
	29-29.3	23	<0.5	
B85-4	0-1.5	12	<0.5	
	5	12	1.5	13
	10-11.5	6	<0.5	
	15-16.5(b)	8	<0.5	
	15-16.5(b)	7	<0.5	
	20-21(b)	51	<0.5	
	20-21(b)	38	<0.5	
B85-5	0.5-2.0	75	<0.5	
	10-11	55	<0.5	
	15-16.5(b)	200	1.5	1
	15-16.5(b)	210	2.5	î
	25	63	0.5	1
	30	30	<2.5	•
B85-6	0-1.5	25		
0-00	5-6.5		<2.5	
		24	<2.5	
	10-11.5	35	<0.5	
	15-16.5(b)	190	<2.5	
	15-16.5(b)	180	<0.5	_
•	20-21.5(b)	200	1.5	1
	20-21.5(b)	200	1.5	1
	25	67	<0.5	
	30	43	0.5	1

(Continued)

(Sheet 1 of 3)

Table 1 (Continued)

Soil Sample Designation	Depth ft	Total Cr. ppm	Cr(VI)	% Cr(VI)
B87-8	0-1 13	22 50 39	<0.5 <0.5 <0.5	
	14 19.5	28	<0.5	
B87-9	1.5 12.5	37 12	0.6 <0.5	2
	19.5(b)	40	0.6	2 2
	19.5(b) 24.5	38 21	0.6 <0.5	•
B87-10	0.5	430	<0.5	2
	7.5	28	0.6	2 1
	12.5(b)	41	0.6 0.5	î
	12.5(b)	44 56	0.6	ī
	16.5 20.5	45	0.7	2
B87-11	16	17,000	750	4
50, 11	16.5	12,000	470	4 2
	17.5	3,100	67	2
PW-1A	18.5	20	NA	
PW-1B	17.5	88	NA	
S 7	1	6,900	540	. 8
<i>5.</i>	2	2,000	170	9
	3	1,200	67	6
S 8	1	3,900	300	8
30	2	12,000	430	4
	3	9,200	430	5
S 9	1	610 700	2.3 3.5	0 1
	2	360	2.4	1
S10	1	26	0.3	ī
	2 3	15	0.2	1
S-1-1	1	590	61	10
S-1-3	3	300	NA	
S-2-1	1	6,200	1,300	21
S·3-1	1	6,500	400	6
S-3-3	3	230	NA	
5-4-1	1	23	0.2	1
S-4-3	3	10	NA	

(Continued)

(Sheet 2 of 3)

Table 1 (Concluded)

Soil Sample Designation	Depth ft	Total Cr. ppm	Cr(VI)ppm	% Cr(VI)
S-5-2	2	330	4.8	1
8-5-4	4	160	22	14
S-6-2	2	7,800	950	12
S-6-3 1/2	3.5	4,100	1,200	29

S/S treatment systems

- 8. Solidification/stabilization systems that have potential application to the FHC soils include:
 - a. Portland cement processes,
 - b. Pozzolan processes.
- 9. Portland cement processes use Portland cement to produce a type of soil/concrete composite. Contaminant migration is reduced by microencapsulation of the contaminants in the concrete matrix. The addition of soluble silicates to Portland cement processes may accelerate hardening. As with lime/fly ash and other pozzolanic systems, metals are also converted to less soluble forms.
- 10. Pozzolanic processes use the finely divided, noncrystalline silica in fly ash and the calcium in lime to produce low-strength cementation. Waste containment is produced by entrapping the waste in the pozzolan concrete matrix (microencapsulation). Metals are also converted to less soluble forms that further inhibit leaching.

Objective and Scope of Study

General objective

- 11. The general objectives of this study were to
 - <u>a</u>. Determine the effects of S/S techniques on contaminated soils from the FHC site.
 - b. Evaluate the physical and chemical properties of the solidified/stabilized soils to determine if S/S techniques will substantially reduce the chromium (VI) to chromium (III), reduce the amount of contaminants in the leachate, and improve the physical handling properties of the soil.

Specific objective

- 12. The specific objective of this treatability study was to develop S/S formulations (one for each type of soil) that, if incorporated in a remedial soil S/S treatment action at the site, will effectively eliminate leaching of chromium from the soils and consequently protect groundwater from further degradation. The following treatment goals were established for the S/S process:
 - a. The treated soils should have a minimum unconfined compressive strength (UCS) of 50 psi, or the minimum defined by local building codes, whichever is greater.

- b. Chromium in the Toxicity Characteristic Leaching Procedure (TCLP) extracts of treated soils should not exceed 5.0 mg/L.
- c. Chromium concentrations in one extraction of the Monofilled Waste Extraction Procedure (MWEP-1) extracts should not exceed 0.05 mg/L.
- <u>d</u>. The permeability of the treated soils should be at least two orders of magnitude less than the permeability of the untreated soils. The goal of the treatment process is to achieve permeability values of 1×10^{-8} cm/sec.
- e. The treated soil should exhibit high wet/dry durability. Loss of 30 percent solids after 12 cycles constitutes failure.

Organization of Report

- 13. This report is divided into four basic sections:
 - a. Part I briefly describes the background for this study and introduces the concept of S/S.
 - <u>b</u>. Part II describes the methods used for sampling, treatment, and testing of the contaminated soil.
 - e. Parts III and IV describe the results of physical and contaminant mobility testing of the S/S soil.
 - <u>d</u>. Part V presents conclusions and recommendations based on the results of the testing program.
- 14. Additional information on the study methods and test results is presented in seven appendixes: initial screening test by WES (Appendix A), results of physical tests on untreated fill and untreated clay (Appendixes B and C), results of physical and chemical tests on treated fill and treated clay (Appendixes D and E), and Radian, Inc., laboratory procedures (Appendix F).

PART II: MATERIALS AND METHODS

General Approach to the Investigation

- 15. This investigation was conducted in the six primary phases summarized below and illustrated in Figures 2-4.
 - a. Phase I: Identification of Vendors. CEMRK advertised in the Commerce Business Daily (27 February 1990) for vendors interested in participating in an evaluation of S/S technology for application to contaminated soils collected from the FHC site. Forty-three vendors responded to the initial advertisement. Following the exchange of fact sheets, seven vendors agreed to participate in the study. In addition, the WES participated as an eighth "vendor" by preparing a generic S/S mix.
 - <u>b. Phase II: Sample Collection.</u> Five gallons each of clay and fill material were shipped to six vendors and WES for pretesting. Vendor 4 did not receive samples because of logistical problems within their laboratory. Samples of contaminated fill and clay were collected and shipped to WES by Radian, Inc. (the CEMRK contractor), for the vendor demonstration.
 - C. Phase III: Preliminary Testing. Vendors performed preliminary tests to determine the additives and additive-to-soil ratios (ASR, a fraction based on wet weight) for preparation of the specimens at WES. The preliminary testing results for the vendors are not presented. WES conducted a preliminary investigation that included an evaluation of binders and a chromium reduction study (CRS). The results are presented in a later section.
 - d. Phase IV: Preparation of Test Specimens for Detailed Evaluation. Test specimens for detailed evaluation of solidified/stabilized fill and clay were prepared by WES and vendors.
 - e. Phase V: Detailed Evaluation. Physical characteristics of the treated soil were evaluated by WES using the UCS, bulk density, permeability, slump, bleed water, cracking, moisture content, specific gravity, set time, and wet/dry tests. Contaminant-release tests were conducted by Radian, Inc., using the TCLP and MWEP-1. Radian, Inc., also conducted bulk chemistry analyses.
 - f. Phase VI: Data Analysis and Report Preparation. Data from WES and Radian, Inc., were consolidated and evaluated.

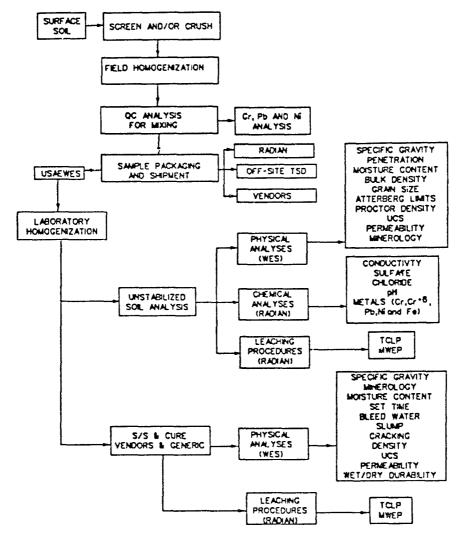


Figure 2. Schematic of S/S treatability study for fill

Sample Collection

Materials of interest

16. The materials of interest were contaminated soils obtained from the FHC site. Contaminants of interest included chromium (VI) and total chromium (Gr). Based upon the points of known high contaminant concentration, a composite sample was collected by personnel of Radian, Inc., during the week of 21 May 1990. Samples were collected from the 12- to 14-ft depth for the fill and the 14- to 16-ft depth for the clay. Five gallons each of clay and fill

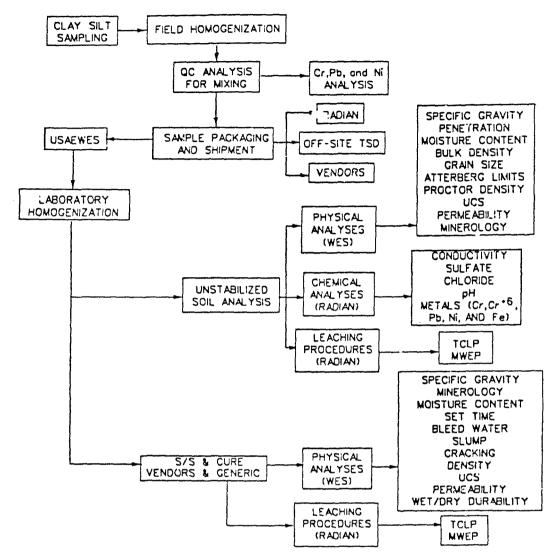
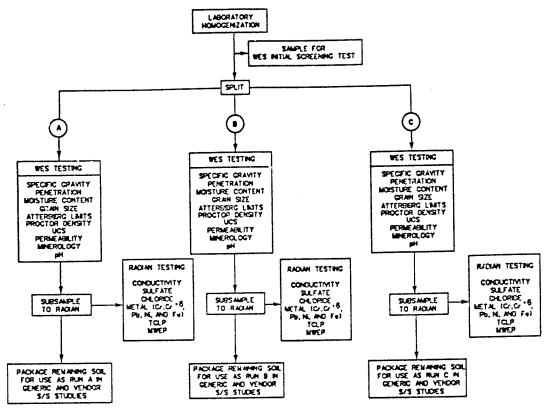


Figure 3. Schematic of S/S treatability study for clay

were shipped to each vendor for development of their S/S process. Clay and fill (255 gal each) were collected and shipped to WES. Upon receipt at WES, the sample was placed in cold storage to await implementation of the S/S evaluation protocol.

17. Homogenization of the FHC fill and clay was conducted in the field by Fadian, Inc., before shipment to the WES. Homogenization consisted of manual mixing and mechanical mixing with an auger. The clay and fill arrived at WES in 102 five-gallon buckets, i.e., 51 buckets of clay and 51 buckets of fill. WES homogenized the fill manually and sieved the material through a



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Figure 4. Schematic of the S/S process

1/2-in. screen. Selection of a 1/2-in. screen was based upon the particle sizes allowable for the molds to be used in physical testing. The clay was not homogenized manually due to the texture of the material. The fill and clay were separately placed into three 85-gal drums each and mixed with a hydraulic mixer. Each set of three drums was intermixed twice and homogenized with the hydraulic mixer for both the fill and clay.

- 18. To ensure that soils collected for S/S studies were in fact contaminated and for comparison of the results for treated soils, Radian, Inc., performed a MWEP-1 and a bulk chemical analysis on the untreated soils collected at the sample points located as shown in Figure 5. Tables 2 and 3 present the results of these analyses for the fill and clay, respectively. Materials classification
- 19. Clay and fill collected from the site were classified according to US Geological Survey (USGS) classifications as sandy silt and sandy, silty

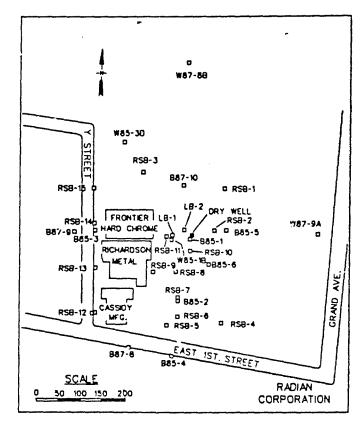


Figure 5. Sample collection points on the FHC site

gravel, respectively. USGS classifications for the clay and fill were MH and GM, respectively.

Preliminary Testing

20. Six vendors and the WES received fill and clay samples to conduct preliminary testing before preparation of the specimens for detailed evaluation at WES. The results of the preliminary testing conducted by the vendors were not reported; the methods and results of the WES preliminary tests are presented in Appendix A. Vendor 4 did not receive samples for the preliminary testing; however, this vendor did participate in the detailed evaluation phase.

Table 2

Results of Chromium Analysis Conducted on Fill by Radian, Inc.,

for the Frontier Hard Chrome Site

Boring No.	Soil Cr mg/kg	MWEP Cr mg/L	Soil Cr(VI) mg/kg	MWEP Cr(VI) mg/L
RSB-1	51	0.007	ND*	ND
RSB-2	11	0.003	0.12	ND
RSB-3	16	ND	ND	ND
RSB-4	24	ND	0.26	ND
RSB-5	6.3	0.011	ND	0.009
RSB-6	22	ND	0.16	ND
RSB-7	3,430	0.168	11	0.174
RSB-8	1,180	1.37	22	ND
RSB-9	62	0.054	0.71	0.053
RSB-10	180	0.239	24	0.206
RSB-11	5,100	0.719	150	
RSB-12	170	0.063	0.15	ND
RSB-13	640	0.095	1.4	ND
RSB-14	420	ND	0.73	ND
RSB-15	19	0.004	0.08	ND
Large boring	1,570	0.395	32	0.354

^{*} Not detected.

Table 3

Results of Chromium Analysis on Clay Conducted by Radian, Inc.,

for the Frontier Hard Chrome Site

Boring	Soil Cr mg/kg	MWEP Cr mg/L	Soil Cr(VI)mg/kg	MWEP Cr(VI)
No. RSB-1	47	0.005	ND*	ND
RSB-2	23	ND	0.17	ND
RSB-3	31	ND	ND	ND
RSB-4	30	ND	ND	ND
RSB-5	37	ND	ND	ND
RSB-6	50	ND	ND	0.008
RSB-7	640	0.405	1.7	0.372
RSB-8	1,100	0.134	3.2	0.120
RSB-9	66	0.313	0.1	ND
RSB-10	380	3.19	50	2.67
RSE ·11	110	0.008	0.61	0.079
RSB-12	580	0.017	0.58	ND
RSB-13	44	0.007	0.19	ND
RSB-14	84	ND	ND	ND
RSB-15	33	ND	0.06	ND
Large boring	2,630	0.065	10	0.070

^{*} Not detected.

Initial screening tests

- 21. The WES conducted preliminary tests that included minimum evaluation of binders and water addition. The objectives of the initial screening test were threefold: (a) to determine the appropriate water-to-soil ratio (WSR), a fraction of water to wet soil; (b) to select the binder for preparation of specimens for detailed evaluation; and (c) to select the appropriate ASR for detailed testing.
- 22. Although the clay and fill had considerable moisture content, it was necessary to add water to the contaminated fill and clay for S/S to be effective. Initial screening tests were conducted on a wide range of ASRs and WSRs. The matrices of test specimens prepared for fill and clay during the WES initial screening test are presented in Appendix A.
- 23. Determination of the appropriate WSR and ASR for preparation of clay and fill specimens for detailed evaluation was based on the results of the cone index (CI) test performed on the initial screening test specimens after they had cured for 1, 4, 8, and 24 hr. The CI measures the resistance of a material to the penetration of a 30-deg right circular cone. The method specified in Technical Manual (TM) 5-530 was followed (Headquarters, Department of the Army (HQDA) 1971). The CI value is reported as force per unit surface area (pounds per square inch) of the cone base required to push the cone through a test material at a rate of 72 in./min. Two cones are available for this test: the standard WES cone having an area of 0.5 sq in. and the airfield penetrometer having a base area of 0.2 sq in. It was necessary to use the standard WES cone on material with a CI less than 100 psi and to use the airfield penetrometer on materials with a CI greater than 100 psi. The maximum CI value that can be measured by the airfield penetrometer is 750 psi; therefore, materials having CI values greater than 750 psi are reported simply as >750 psi.
- 24. The results of the initial screening test define the appropriate ASR required to produce physical strength and narrow the range for a selection of a WSR. The test specimens generated during the initial screening test were not used for further evaluation.

Chromium reduction study

25. The objectives of the WES chromium (VI) reduction study were:
(a) to determine if reagents could be added to the fill and clay to reduce Cr(VI) to Cr(III), (b) to determine the dosages of reagent necessary for

reduction of Cr(VI) to Cr(III), and (c) to determine the reaction time required for reduction of Cr(VI) to Cr(III).

26. Blast furnace slag (BFS) and ferrous sulfate were selected as additives for reduction of Cr(VI). A wide range of ASRs were evaluated to determine the amount of additive necessary to reduce Cr(VI) to Cr(III). The minimum BFS to soil ratio and ferrous sulfate to soil ratio was selected based on stoichiometric ratios of initial Cr(VI) concentrations. The appropriate ASRs for the clay and fill to be prepared in the detailed evaluation were determined by analysis of the treated specimens for Cr(VI) according to SW-846 Method 3060 (USEPA 1986d) with modifications. The reagents used were 0.1N NaOH, 0.1N Na₂CO₃, 10% H_2 SO₄, and a color reagent (see SW-846 Method 7196). The method of extraction was to add 50 ml each of 0.1N NaOH and 0.1N Na₂CO₃ to 25 g of the clay or fill, tumble for 2 hr, and filter with a 0.45- μ filter; the leachate was analyzed according to SW-846 Method 7196. For leachate analysis, 3 ml of 10% H_2 SO₄ and 2 ml of the color reagent were diluted to 95 ml according to SW-846 Method 7196.

Preparation of Test Specimens for Detailed Evaluation

General description of S/S process

27. Solidified specimens were prepared by mixing water and additives with the contaminated clay and fill in a Hobart H600T mixer. The soil and additives were mixed for 5 min, after which the sides of the container were scraped to remove material adhering to the sides of the container. After scraping, the mixture was mixed an additional 5 min. Variations from this method, if any, are discussed for each vendor in the paragraphs that follow. Immediately after mixing was completed, a slump test was conducted according to methods described in ASTM C 143-89 (ASTM 1990). The remaining water/ additive/soil slurry was poured into molds for physical and chemical testing. To aid in removing test specimens from the molds, a light coat of grease was applied to the molds used to cast the UCS specimens. Specimens used for the bulk chemistry, MWEP-1, and TCLP were prepared in ungreased molds. Immediately after the additive/water/soil mixtures were placed in the molds, they were vibrated on a Sentron model VP61D1 vibration table to remove voids. Visual observations of the specimens were recorded for the bleed water test according to methods in ASTM C 232-87 (1990). For some vendor sample preparations, the additive/water/contaminated soil mixture was very viscous, and

vibration was an ineffective method for removing voids. These specimens were tamped according to ASTM C 109-86 (ASTM 1990) using a model CT-25A tamper.

- 28. The molded, solidified/stabilized materials were cured in the molds at 23 °C and 98-percent relative humidity for a minimum of 24 hr. Specimens were removed from the molds when they developed sufficient strength to be free standing, and were cured under the same temperature and relative humidity conditions until further testing.
- 29. After the solidified/stabilized soil was cured, the physical and chemical properties of the solidified/stabilized soil were determined. The UCS, moisture content, bulk density, permeability, specific gravity, set time, slump, and wet/dry tests were used to determine the physical characteristics, and the TCLP and MWEP-1 were used to measure the leachability of the contaminants from the solidified/stabilized soil.
- 30. One formulation was prepared by each vendor for each of the clay and fill materials. Additive systems developed by each vendor were used to solidify/stabilize the soil and are differentiated by the type of additive material used in the process. The processes selected by the vendors are discussed below.

Preparation of fill material specimens

31. <u>Vendor 1.</u> Vendor 1 added two proprietary additives (Ensol and Landtreat) and water. Ensol contains sodium silicate and a chelating agent. Landtreat is an insoluble polysilicate. Vendor 1 varied the amount of Ensol among replicates according to the following schedule.

Replicate	WSR	Ensol	Landtreat
Α	0.02	0.04	0.05
В		0.04	0.07
С	0.02	0.08	0.10

For replicates A and C, Vendor 1 added WSRs of 0.02 but added no water to replicate B. Vendor 1 added Ensol and Landtreat to the fill and initiated mixing. During the first 5 min of mixing, they slowly added 400 ml of water to replicate A. As mixing progressed, Vendor 1 decided to add an additional 150 g of Landtreat powder due to the apparent moisture in the mix. Vendor 1 added Ensol and Landtreat to replicates B and C after initiation of mixing but did not add water to replicate B. The replicate mixtures were mixed for 5 min, scraped, and mixed for an additional 5 min.

32. <u>Vendor 2</u>. Vendor 2 added cement and a chemical reducing agent to the fill at the following ASRs.

Replicate	WSR	Cement	Chemical Reducing Agent
A		0.15	0.05
В		0.15	0.07
С	• •	0.15	0.10

The cement was added at a constant rate of 0.15 ASR for replicates A, B, and C, but the chemical reducing agent ASR was varied (0.05, 0.07, and 0.10 for replicates A, B, and C, respectively). The mixing times were consistent among replicates, and mixing was conducted as discussed in paragraph 27.

33. <u>Vendor 3.</u> Vendor 3 added portland cement, silica, and water to the fill, and ASRs remained consistent for the three replicates.

		Portland	
Replicate	WSR	Cement	Silica
Α	0.09	0.21	0.14
В	0.09	0.21	0.14
С	0.09	0.21	0.14

Vendor 3 added the silica and one half the water, mixed for 5 min, scraped the container, and added the remaining water and portland cement for all replicates.

34. <u>Vendor 4.</u> Vendor 4 added cement, a metal complexing reagent, a cementitious reagent, and water at consistent dosages for the replicates.

Replicate	WSR	Cement	Metal <u>Complex Reagent</u>	Cementitious Reagent
Α	0.20	0.20	0.08	0.05
В	0.20	0.20	0.07	0.05
С	0.20	0.20	0,07	0.05

Vendor 4 used consistent mixing processes for all replicates and began by mixing the metal complexing reagent and slowly adding the fill for 5 min. The container was scraped, and the cement was added. After mixing an additional minute, the cementitious reagent was added, and the mixture was mixed an additional 4 min.

35. <u>Vendor 5.</u> Vendor 5 added cement, sodium silicate, and water to the fill at the ratios listed below.

Replicates	WSR	Cement	Sodium Silicate
A	0.17	0.25	0,20
В	0.17	0.25	0.20
С	0.17	0.25	0.20

Vendor 5 mixed the water, fill, and sodium silicate for 5 min, scraped the container, and then added the cement and mixed for an additional 5 min.

36. <u>Vendor 6.</u> Vendor 6 added cement, ferrous sulfate, and water to the fill at the ASRs listed below.

Replicates	_WSR	Cement	Ferrous <u>Sulfate</u>
A	0.25	0.20	0.02
В	0.25	0.20	0.02
С	0.25	0.20	0.02

Vendor 6 began preparation of their specimens by first adding ferrous sulfate and water to the fill and mixing for 2 min. The cement was then added, and mixing was continued for 3 min. The container was scraped, and the mixture was mixed an additional 5 min.

37. <u>Vendor 7</u>. Vendor 7 used cement, type C fly ash, and Urichem for their process. Water was added to replicate A only.

Replicates	WSR	Cement	Fly Ash	<u>Urichem</u>
Α	0.02	0.06	0.30	0.04
В		0.05	0.30	0.04
С		0.05	0.30	0.04

First, Urichem was added to the fill and mixed for 5 min. The cement and fly ash were composited before they were added to the fill. After mixing, the container was scraped, and the fly ash, cement, and water were added and mixed an additional 5 min.

38. <u>Vendor 8.</u> Vendor 8 added cement, blast furnace slag, and water to the fill at the following ASRs.

Replicates	WSR	Cement	BFS
A	0.15	0.10	0.40
В	0.15	0.10	0.40
С	0.15	0.10	0.40

The cement, BFS, and water were added to the fill before mixing was initiated. The fill and additives were mixed for 5 min, the container was scraped, and the mixture was mixed an additional 5 min.

Preparation of clay material specimens

39. <u>Vendor l.</u> Vendor l varied the amounts of water and additives added among replicates for the clay according to the following schedule.

Replicates	<u>WSR</u>	Ensol	Landtreat
A	0.07	0.08	0.08
В	0.03	0.08	0.08
С	0.06	0.10	0.10

The additives were mixed according to the methods described for the fill (see paragraph 31).

40. <u>Vendor 2.</u> Vendor 2 added cement and a chemical reducing agent to the clay at the following ASRs.

Replicates	WSR	Cement	Chemical Reducing Agent
Α		0.15	0.08
В		0.15	0.08
С		0.10	0.10

Vendor 2 did not add water to any of the replicates. The mixing was conducted according to the methods described for preparation of fill specimens by Vendor 2 (see paragraph 32).

41. <u>Vendor 3.</u> Vendor 3 added portland cement, silica, and water to the clay at the ratios listed below.

		Portland	
<u>Replicates</u>	WSR	Cement	Silica
A	0.23	0.21	0.14
В	0.23	0.21	0.14
С	0.23	0.21	0.14

The clay and additives were mixed according to the methods used by Vendor 3 for the fill (see paragraph 33).

42. <u>Vendor 4.</u> Vendor 4 added water, cement, a metal complexing reagent, and a cementitious reagent to the clay. Vendor 4's cement, metal complexing reagent, and cementitious reagent additions were consistent among replicates at the ASRs listed below.

Replicates	WSR	Cement	Metal Complex Reagent	Cementitious <u>Reagent</u>
A	0.21	0.20	0.07	0.05
В	0.23	0.20	0.07	0.05
C	0.26	0.20	0.07	0.05

The water additions varied for replicates A, B, and C. The mixing process was conducted according to methods used by Vendor 4 for the fill (see paragraph 34).

43. <u>Vendor 5.</u> Vendor 5 added cement, sodium silicate, and water to the clay at the following ratios.

			Sodium
<u>Replicates</u>	WSR	<u>Cement</u>	<u>Silicate</u>
A	0.23	0.25	0.23
В	0.23	0.25	0.20
С	0.24	0.25	0.20

The cement/sodium silicate/water mixture was mixed according to the same methods used for the fill (see paragraph 35).

44. <u>Vendor 6.</u> Vendor 6 added cement, ferrous sulfate, and water to the clay for each of the replicates at the ratios listed below.

Replicates	WSP	Cement	Ferrous Sulfate
A	0.36	0.20	0.02
В	0.37	0.20	0.02
С	0.37	0.20	0.02

The additive/clay mixtures were mixed according to the same methods used by Vendor 6 for the fill (see paragraph 36).

45. <u>Vendor 7.</u> Vendor 7's additives were Urichem, fly ash, cement, and water.

Replicates	WSR	Cement	Fly Ash	<u>Urichem</u>
A	0.11	0.07	0.42	0.04
В	0.11	0.10	0.40	0.04
C	0.12	0.10	0.40	0.04

Additives were added in the order described for the fill and mixed according to the methods used for the fill (see paragraph 37).

46. <u>Vendor 8.</u> Vendor 8 added BFS, water, and cement to the FHC clay at the following ratios.

		_	Blast
Replicates	WSR	Cement	Furnace Slag
A	0.15	0.10	0.36
В	0.15	0.10	0.36
С	0.15	0.10	0.36

The mixture was mixed according to methods described for the mixing methods for the fill (see paragraph 38).

Detailed Evaluation Methods

47. The success of a S/S process can be evaluated in a number of ways. This section describes the protocol of physical and chemical testing methods used to evaluate the effectiveness of S/S.

Physical testing

- 48. The parameters UCS, wet/dry, and permeability were selected to evaluate the physical effectiveness of S/S. Tests of specific gravity, moisture content, bulk density, bleed water, slump, and set time were also used to characterize the treated specimens.
- 49. Unconfined compressive strength. The UCS test was used to characterize the effects of the S/S process on the strength characteristics of the clay and fill materials. The UCS was determined according to ASTM method D 2166 (ASTM 1990). The only deviation from this method was vibration or tamping of the specimens, as previously discussed (see paragraph 27). The UCS tests were performed in triplicate on 3-in.-diam by 6-in.-long cylinders after they had cured for 28 days. Triplicate specimens were tested for each vendor system. The surface area of each cylinder was determined by using a Fowler Max-cal caliper. The force required to fracture the specimens was measured with a Tinius Olsen Super L compression apparatus. UCS was reported as the pounds per square inch required to fracture the cylinder. A UCS goal of 50 psi was chosen based on information found in the Office of Solid Waste and Emergency Response (OSWER) Policy Directive 9487.00-2A (USEPA 1986d).
- 50. Wet/dry. ASTM method D 4843-88 (ASTM 1990) was used to evaluate resistance of the S/S specimens to successive wetting and drying periods. The wet/dry test simulates the effects of weathering on the integrity of the S/S specimens after 28 days of cure. The wet/dry test uses a 1-3/4-in.-diam by 3-in.-long cylindrical specimen. Wet/dry results were reported as the average cumulative, corrected relative mass loss after each cycle. Triplicate test and triplicace control specimens were subjected to the wet/dry test. One specimen was evaluated for moisture content according to ASTM method D 2216 (ASTM 1990). Loss of 30 percent of the original dry weight of the specimen constitutes failure of the test.
- 51. <u>Permeability</u>. Permeability determinations were made by measuring the falling head through a specimen with a triaxial cell according to methods described in Engineer Manual 1110-2-1906, Appendix VII (US Army Corps of Engineers 1970). Permeability tests were run on 3-in.-diam by 3-in.-long

cylinders after a minimum of 28 days for curing. Triplicate readings were performed on each replicate. In some cases, the specimens were shaved in order for them to adjust to the size of the triaxial cell. Permeability was calculated as the time required for a certain head loss through the specimen. A permeability of 1×10^{-8} cm/sec or a permeability two orders of magnitude less than the permeability of the untreated fill/clay was selected as the criterion for the treated specimens.

- 52. Specific gravity. The specific gravity of the S/S specimens was determined according to ASTM method D 854-83 (ASTM 1990). Specific gravity of the specimens expresses the relationship between air, water, and solids in a given volume of material and was determined in triplicate for each vendor formulation after 28 days of cure.
- 53. Moisture content determinations. Moisture content of the specimens was reported as the percentage of dry solids as evaluated according to ASTM method D 2216 (ASTM 1990). Moisture content was used to determine the water content of the untreated and treated specimens, and established consistency among replicates. Moisture contents were reported in triplicate for untreated and treated specimens. Moisture contents of the treated fill and clay were determined after 28 days of cure.
- 54. Workability (slump). Workability of the treated specimens was evaluated using the slump test, ASTM method C 143 (ASTM 1989). Slump was determined by measuring the vertical displacement of the center of the treated sample after 2.5 min. Slump measurements were taken in triplicate for the clay and fill material immediately after preparation of the formulations.
- 55. <u>Bulk density</u>. The bulk densities were determined based on methods described in ASA 13 (American Society of Agronomy 1965). For the untreated material, bulk density was determined on the materials at their Proctor density in triplicate. The bulk density of the treated specimens was determined in triplicate for each replicate after 28 days of cure.
- 56. Set time. Set time was estimated using the cone index (CI) described in TM 5-530 specifications (HQDA 1971). Set time was determined by measuring the resistance of the treated and untreated fill and clay to penetration of an airfield penetrometer (in psi). The CI measurements were taken at 2-, 4-, 8-, 24-, and 48-hr intervals for the treated and untreated specimens in triplicate using 4-in.-diam by 4-in.-long cylinders.

- 57. <u>Bleed water</u>. Bleed water was measured immediately after preparation of the detailed test specimens. Visual observations were noted after the samples were molded.
- 58. <u>Cracking.</u> Evaluation of cracking was conducted visually after extrusion of the specimens from the molds. Surface voids and cracks were reported after 28 days of cure.

Contaminant release testing

- 59. The TCLP and MWEP-1 were selected for evaluation of chromium stabilization success. The TCLP standard is 5.0 mg/L for chromium (40 CFR Part 261), and the MWEP-1 total chromium goal established for the FHC soils was 0.05 mg/L chromium, based on the drinking water maximum concentration level for chromium.
- 60. Toxicity Characteristics Leaching Procedure. The TCLP extracts were analyzed for metals according to the methods and within the time constraints summarized in the <u>Federal Register</u> (USEPA 1990) and specified in SW-846 (USEPA 1986d).
- 61. <u>Monofilled Waste Extraction Procedure-1</u>. The MWEP-1 was analyzed for metals according to methods described in the EPA Technical Resource Document SW-924. Extraction of the specimens was performed one time.
- 62. Quality assurance/quality control. The quality assurance/quality control (QA/QC) for this project was divided between WES and Radian, Inc. The WES was responsible for preparing the solidified/stabilized soil specimens and performing physical tests. Radian, Inc., was responsible for laboratory QA/QC related to the conduct of the MWEP-1, TCLP, and total extractions and chemical analysis of the resulting extracts. The Radian, Inc., QA/QC reports are presented in Appendix G.

PART III: DISCUSSION OF RESULTS FOR FILL MATERIAL TESTING

Analysis of Homogenization

63. A major concern during the conduct of the study was the use of a homogenized sample for the application of the vendor S/S processes. An attempt was made to provide each vendor with a statistically homogeneous sample. The homogeneity of the samples was evaluated by normalizing the total chrome for dilution effects of binder addition, and conducting an analysis of variance (ANOVA) on the normalized chromium values.

Normalization process

64. Normalization of the total chromium and Cr(VI) bulk chemistry analyses indicates the amount of total chromium and Cr(VI) in the samples presented to the vendors and accounts for dilution due to additives in the S/S process. The normalized total Cr and Cr(VI) for each vendor was calculated from the following equation (on a 1 kg dry weight basis):

$$NM_{tox} = C_{tox} \left[\frac{M_s}{B_t \left(1 - \frac{W_{cs/s}}{B_t} \right)} \right]$$
 (1)

 NM_{ter} - normalized concentration of total chromium in soil presented to

 C_{tcr} - concentration of total chromium in the S/S soil (dry weight basis)

M_s - 1 kg dry solids (per kilogram dry solids basis)

 B_t - weight fraction of fill/clay in S/S waste, calculated as

$$B_{c} = \frac{M_{s} + M_{s}(w_{cs/s})}{M_{s} + M_{s}(ASR)}$$

 $w_{cs/s}$ - water content of S/S fill/clay

65. Normalized mass leached concentration (NMLC) chromium values in the MWEP-1 and TCLP were calculated to compensate for the dilution effects of adding water and binder to the fill.

66. For the untreated fill, the following equation was used:

$$Cd_{r} = \frac{C_{r}}{W_{r} \times M_{r}} \tag{2}$$

where

 Cd_{r} - contaminant mass/dry weight untreated waste, mg/kg

C_r = untreated fill/clay mass for the contaminant of interest, mg
 (calculated as: extract contaminant concentration (mg/L)
 x extraction solution volume, L)

 W_r - weight of fill/clay extracted, kg

 $M_{\rm r}$ - solids content of the untreated fill/clay used in the extraction expressed as a decimal

67. The equation for treated NMLC was

$$Cd_{t} = \frac{C_{e}}{W_{t} \times M_{t} \times B_{t}} \tag{3}$$

where

Cdt - contaminant concentration/dry weight waste after S/S, mg/kg

Ct = S/S fill/clay mass for the contaminant of interest, mg (calculated as: extract contaminant concentration (mg/L) x extraction solution volume, L)

Wt - weight of wet S/S fill/clay, kg

M_c = solids content of the S/S fill/clay used in the extraction, expressed as a decimal

68. The efficiency of the S/S treatment was calculated from the following formula:

$$Eff. = \frac{Cd_r - Cd_t}{Cd_r} \times 100 (4)$$

Analysis of Variance

69. An ANOVA conducted on the normalized total chromium concentrations demonstrated the homogeneity of the samples received by the vendors for their demonstration. Normalization of the total chromium in the fill was performed to account for dilution effects caused by addition of additives in the mixing process. The results of the normalization of total chromium and Cr(VI) for bulk chemistry are presented in Table 4. An analysis of variance was conducted on the treated and untreated fill for normalized total chromium to determine variability among vendors; these results are presented in Table 5.

Chrome Reduction Study

70. The results of the WES chromium (VI) reduction study are presented in Table 6 and discussed below. Two additives were tested, BFS and ferrous sulfate, at varying dosages and reaction times.

Untreated fill

71. Cr(VI) analyses were conducted in triplicate on the untreated fill. The average concentration was 7.74 mg/kg.

Blast furnace slag

72. Four ASRs were tested for the BFS: 0.018, 0.1, 0.2, and 0.36. At the lowest ASR, the average concentration of Cr(VI) remained >10 mg/L after 24 hr. At an ASR of 0.1, the average concentration of Cr(VI) decreased to 4.57 mg/L after 24 hr. The lowest average concentration of Cr(VI) was 3.53 mg/L for an ASR of 0.36. An ASR for BFS/fill of 0.40 was selected for the detailed evaluation due to more effective reduction of Cr(VI) in the BFS-treated fill than in the ferrous sulfate-treated fill. The increase in BFS from an ASR of 0.36 in the CRS to 0.40 for the detailed evaluation is based on a direct relationship between increased ASRs to decreased Cr(VI) concentrations demonstrated in the CRS.

Ferrous sulfate

73. The results of the CRS for ferrous sulfate were not consistent for an additive-to-soil ratio of 0.00052. The average concentration was initially 3.78 mg/kg, and after 24 hr was 5.94 mg/kg. At the 0.0013 ASR, the initial average concentration was 3.29 mg/kg and decreased with time to 2.04 mg/kg after 24 hr.

Table 4

Results of Normalizing Total Chromium and Cr(VI) for

Treated and Untreated Frontier Hard Chrome Fill*

	Mean	Norm.	Mean	Norm.
	Total Cr	Total Cr	Cr(VI)	Cr(VI)
Vendor	mg/kg	mg/kg	mg/kg_	mg/kg
		Untreated Fill		
	1,567		32.0	
		Treated Fill		
1	1,090	1,277	0.075	0.088
2	1,000	1,268	2.0	2.5
3	790	1,147	3.5	5.1
4	963	1,436	4.5	6.3
5	787	1,297	3.6	6.6
6	1,077	1,438	3.6	4.8
7	1,147	1,710	3.2	4.8
8	643	1,082	0.086	0.10

^{*} Treatment objective was total chromium ≤ 0.05 mg/L.

Table 5

Results of ANOVA for Bulk Cnemistry Conducted

on Untreated Fill

Vendor	Mean NMLC (mg/kg)
7	1,710
*	1,566
6	1,438
4	1,436
5	1,297
1	1,277
2	1,268
3	1,146
8	1,082

^{*} Untreated fill.

Table 6
Results of Chrome Reduction Study for Fill*

			hr	
0	2	4	6	24
11.30	9.48	13.53	10.66	10.34
12.92	14.84	11.13	4.86	4.57
7.70	7.78	7.67	5.58	4.00
3.44	9.81	7.75	7.44	3.53
	•			
3.78	3.71	1.43	1.57	5.94
3.29	1.59	1.50	1.30	2.04
	11.30 12.92 7.70 3.44	11.30 9.48 12.92 14.84 7.70 7.78 3.44 9.81 3.78 3.71	11.30 9.48 13.53 12.92 14.84 11.13 7.70 7.78 7.67 3.44 9.81 7.75	11.30 9.48 13.53 10.66 12.92 14.84 11.13 4.86 7.70 7.78 7.67 5.58 3.44 9.81 7.75 7.44 3.78 3.71 1.43 1.57

Note: Average Cr(VI) concentration in the untreated fill was 7.74 mg/kg. * Results are presented as mg/kg of Cr(VI).

Initial Screening Test Results

74. The results of the initial screening test on the fill conducted by WES are summarized below. The detailed results are presented in Appendix A. Each time a stabilization process was applied, a batch of material was generated. As shown, 8 batches each of solidified fill were prepared for the cement, and 15 batches were prepared for the lime/fly ash process.

Cement binder

75. In the initial screening test, water ratios of 0.1 and 0.3 were tested to evaluate the effects of water addition on strength development. After 24 hr, a 0.1 ASR/0.1 WSR gained strength >750 psi. At ASRs of 0.4 and 0.7 combined with a WSR of 0.1, CI values were >750 psi after 3 hr of cure. At the 0.1/1.4 WSR/ASR, CI values >750 psi were measured after 1 hr of cure. A WSR/ASR of 0.3/0.1 had an average CI measurement of 100 psi after 24 hr of cure. ASRs of 0.4, 0.7, and 1.4 with a WSR of 0.3 had CI values >750 psi after 24 hr. The 0.1 ASR tested with a WSR of 0.1 gained strengths >750 psi with sufficient hydration of the sample and was the basis of selection of a 0.1/0.1 WSR/ASR for detailed evaluation.

Lime/fly ash binder

76. The 0.4/0.1 lime/fly ash ASR combined with a WSR of 0.1 was the only mixture with a CI value approaching 750 psi. The average CI value after

24 hr for the 0.4/0.1/0.1 lime/fly ash/water ASR/WSR mixture was 703 psi. The highest average CI value after 24 hr for a WSR of 0.3 was 280 psi. Cement was selected by WES for evaluation because of its greater strength development than lime/fly ash. No further evaluations of lime/fly ash treatment of the FHC fill were conducted.

Results of Physical Testing of Fill Material

- 77. The results of the bulk density, Atterberg limits, Proctor density, UCS, permeability, specific gravity and set time for the untreated fill are summarized in Table 7. The results of grain size and moisture content analyses for the fill are presented in Appendix B.

 UCS results
- 78. UCS measurements were performed in triplicate for each replicate after 28 days of cure. Figure 6 presents the results of the UCS tests conducted on the treated fill. All specimens developed strengths greater than the 50-psi criterion.
- 79. <u>Untreated fill</u>. The untreated specimens were prepared at the Proctor density and cured for 28 days but were not cohesive enough to conduct UCS tests on the replicates. Specimens were cured for 28 days to enable direct comparison with the results obtained with the treated specimens, which were also cured for 28 days. Curing also allowed the evaluation of the untreated fill material for self-setting properties.
- 80. <u>Vendor 1.</u> The Ensol/Landtreat process did not produce cementitious properties. Extrusion of the samples from the molds damaged the replicates to such an extent that no UCS measurements could be made.
- 81. <u>Vendor 2.</u> The average UCS values of replicates A, B, and C were 231, 118, and 105 psi, respectively. UCS measurements were taken on only one specimen of replicate C due to fracture of two specimens during extrusion. ASRs for the chemical reducing agent varied among replicates, possibly causing the wide range in UCS results. All specimens evaluated had UCSs >50 psi.
- 82. <u>Vendor 3.</u> Average UCS values for replicates A, B, and C were 455, 481, and 565 psi, respectively. Vendor 3 was consistent in ASRs of Portland cement and silica to the replicates, and all replicates developed strengths greater than 50 psi.
- 83. <u>Vendor 4.</u> The average UCS readings for replicates A, B, and C were 351, 383, and 153 psi, respectively. Although Vendor 4 added the same

Table 7
Results of Physical Tests Conducted on Untreated Fill

		Replicate	
Parameter	A	<u> </u>	C
Bulk density, pcf	86.4	84.2	77.8
Proctor density, pcf	149.7	150.3	148.4
Specific gravity	2.70	2.69	2.69
Resistance to penetration, psi*	87	113	110
Permeability, cm/sec*	8.59E-05	2.83E-04	5.56E-05
UCS, psi	N/A	N/A	N/A
Moisture, % dry weight**	28.77	26.22	27.45
Atterberg limits			
Plasticity index	5 .	4	10
Liquid limit	37	44	43
Plastic limit	32	40	33

^{*} Represents an average of three replicates.

^{**} Represents an average of 33 replicates.

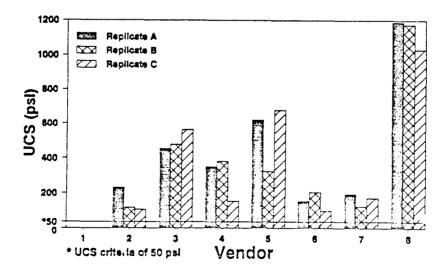


Figure 6. 28-day UCS results for the $\,$ FHC fill

amount of binder to each replicate, replicate C developed less strength than replicates A and B. The reactions within S/S processes are not clearly understood, and explanations for higher/lower strength development are not easily determined. All replicates developed strengths greater than 50 psi.

- 84. <u>Vendor 5.</u> The average UCS values for replicates A, B, and C were 620, 324, and 678 psi, respectively. Although Vendor 5 used the same ASR and WSR for all replicates, two specimens of replicate B had UCSs of 251 and 176 psi, while the remaining UCSs were greater than 500 psi.
- 85. <u>Vendor 6.</u> The average UCS values were 154, 204, and 97 psi, for replicates A, B, and C, respectively. Although the same ASRs were used throughout the Vendor 6 demonstration, the average UCS of replicate B was twice the average UCS of replicate C. All replicates developed strengths greater than 50 psi.
- 86. <u>Vendor 7.</u> The average UCS values for replicates A, B, and C were 195, 125, and 171 psi, respectively. Two specimens of replicate B gained less strength (88 and 89 psi) than the other specimen (198 psi). Vendor 7 added ASRs of 0.058 cement and 0.052 cement to replicates A and C, respectively, and an ASR of 0.049 to replicate B. The lower ASR used for replicate B may have resulted in the lower UCS values. All replicate UCSs were greater than the 50-psi criteria.
- 87. <u>Vendor 8.</u> The average UCS values for Vendor 8 were 1,190, 1,175, and 1,032 psi for replicates A, B, and C, respectively. Vendor 8 ASRs and WSRs were consistent among replicates. Vendor 8 specimens developed the highest strengths of any process evaluated. One specimen of replicate C developed less strength than the remaining replicates (774 psi), but all replicates gained strengths much greater than 50 psi. Wet/dry results
- 88. To determine the durability of the specimens, the wet/dry test was conducted on three test specimens and three control specimens after 28 days of cure. Moisture contents were determined on one specimen in order to evaluate the percent solids loss for the specimens. The specimens were subjected to 12 cycles of wetting and drying, and the weight of the specimen was taken after each cycle to determine the loss during that cycle. The average results of the wet/dry test for the fill are presented in Table 8. The detailed results by replicate are presented in Appendix C.

Table 8

Results of the Wet/Dry Tests Conducted
on Frontier Hard Chrome Fill

Vendor	ACCRML After 12 Cycles g	Test Specimen (% Loss)	Control Specimen (% Loss)
1	NA	100	100
2	-0.11*	0.32	0.42
3	-0.07*	0.23	0.30
4	-0.08*	0.39	0.47
5	-0.11*	0.36	0.47
6	-0.05*	0.49	0.53
7	-0.24*	0.83	1.07
8	0.03	0.17	0.01
Goal		30	30

^{*} Negative result due to greater average relative mass loss in control sample than in treated sample.

- 89. <u>Vendor 1.</u> The wet/dry specimens prepared by Vendor 1 did not develop sufficient durability and failed the wet/dry test after one cycle. The test and control specimens deteriorated when subjected to the water-addition portion of the cycle, and 100 percent of the specimen solids was lost.
- 90. <u>Vendor 2.</u> The wet/dry test and control specimens prepared by Vendor 2 passed 12 cycles of the wet/dry test. There was no significant loss of material from the specimens during the 12 wet/dry cycles. The average percent solids lost from the test specimens was 0.32 percent, and the percent solids lost from the controls was 0.42 percent. The average cumulative, corrected relative mass loss (ACCRML) after 12 cycles was -0.11 g for the fill. The negative result is due to a greater mass loss in the control specimens than in the test specimens.
- 91. <u>Vendor 3.</u> The test specimens lost 0.23 percent of the solid mass in 12 cycles, and the controls lost 0.30 percent in 12 cycles. Specimens for the fill had an ACCRML of -0.07 g. The control specimens lost more mass than the test specimens; therefore, the result of the ACCRML was negative. All test and control specimens passed 12 cycles of the wet/dry test.
- 92. <u>Vendor 4.</u> The test and control specimens lost averages of 0.39 and 0.47 percent of the solid mass, respectively. The ACCRML results of the wet/

dry test for the test and control specimens were -0.08 g. The control specimens lost slightly more sample that the test specimens, but there was no significant loss of sample from the test or control specimens. All specimens passed 12 cycles of the wet/dry test.

- 93. <u>Vendor 5.</u> The test and control specimens prepared by Vendor 5 passed 12 cycles of the wet/dry test. The average solids loss for the test and control specimens was 0.36 and 0.47 percent, respectively. There was a greater mass loss from the controls than the test specimens, which is represented by an ACCRML of -0.11 g.
- 94. <u>Vendor 6.</u> The average solids loss from the test and control specimens was 0.49 and 0.53 percent, respectively. The ACCRML for the test and control specimens prepared by Vendor 6 was -0.05 g. The control specimens lost slightly more sample than the test specimens, causing a negative ACCRML. All specimens passed 12 cycles of the wet/dry test.
- 95. <u>Vendor 7.</u> The test and control specimens passed 12 cycles of the wet/dry test with an average solids loss of 0.83 percent and 1.07 percent, respectively. The control specimens lost more cumulative sample than the test specimens, and as a result, the ACCRML was -0.24 g.
- 96. <u>Vendor 8.</u> The average solids loss for the test and control specimens was 0.17 and 0.01 percent, respectively. The ACCRML for the Vendor 8 test and control specimens was 0.03 g. The test specimens lost more mass than the control specimens, but all specimens passed 12 cycles of the wet/dry test. <u>Permeability results</u>
- 97. The results of the permeability test conducted on the untreated and treated fill are summarized in Table 9 and represented in Figure 7. Triplicate readings were conducted on each replicate to obtain an average permeability after 28 days of cure. Detailed results of permeability testing are presented in Appendix C.
- 98. <u>Untreated fill.</u> The specimens were prepared at the Proctor density and cured for 28 days. The average permeabilities of replicates A, B, and C were 8.59E-05, 2.83E-04, and 5.56E-05 cm/sec, respectively. The average permeability of the replicates is 1.4E-04 cm/sec.
- 99. <u>Vendor 1</u>. The average results for the triplicate readings of the permeability tests conducted on replicates B and C were 6.52E-07 and 1.02E-06 cm/sec, respectively. No readings were taken for replicate A because of the destruction of the replicates during extrusion from the molds. Replicate A contained the highest percentage of water added and the lowest

Table 9
Summary of Permeability Test Results for the Fill

Vendor	Replicate	Average Fermeability cm/sec
*	A	8.59E-05
	В	2.83E-04
	c	5.56E-05
Vendor 1	A	NA
	В	6.52E-07
	С	1.02E-06
Vendor 2	A	3.04E-05
	В	1.61E-04
	С	3.62E-05
Vendor 3	A	2.89E-06
	В	1.41E-06
	С	1.62E-06
Vendor 4	A	1.02E-05
	В	7.15E-06
	С	9.38E-07
Vendor 5	A	2.33E-07
	В	3.47E-06
	С	4.92E-06
Vendor 6	A	1.79E-05
	В	7.45E-06
	С	6.36E-06
Vendor 7	A	1.17E-05
	В	9.98E-07
	С	1.34E-06
Vendor 8	A	1.15E-07
	В	NA
	C	3.00E-06

^{*} Untreated fill.

percentage of binder added in the soil/additive mixture prepared for the three replicates. None of the replicates attained the criteria of 1E-08 cm/sec.

100. Verdor 2. The average permeabilities of replicates A, B, and C were 3.04E-05, 1.61E-04, and 3.62E-05 cm/sec, respectively. The average permeability of the treated replicates was 7.59E-05 cm/sec. None of the replicates attained the criteria of 1E-08 cm/sec.

101. Vendor 3. The average permeabilities of replicates A, B, and C were 2.89E-06, 1.41E-06, and 1.62E-06 cm/sec, respectively. The average

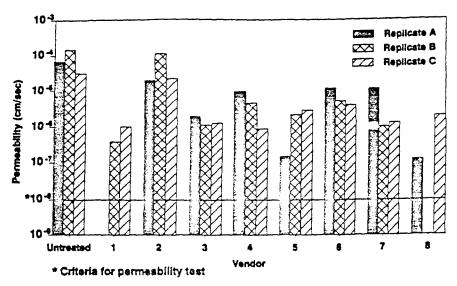


Figure 7. 28-day permeability results for FHC fill

permeabilities of the triplicate readings of replicate B and C were orders of magnitude less than the permeabilities of the untreated fill. The average permeabilities of replicates A and C of the treated fill were one order of magnitude less than the permeabilities of replicates A and C for the untreated fill. The permeabilities were greater than the 1E-08 cm/sec criteria.

- 102. <u>Vendor 4.</u> The average permeabilities for the three replicates A, B, and C were 1.02E-05, 7.15E-06, and 9.38E-07 cm/sec, respectively. None of the replicates was two orders of magnitude less than the permeabilities of the untreated fill, and all were greater than the 1E-08 cm/sec criteria for permeability of the treated fill.
- 103. <u>Vendor 5.</u> Replicate A had an average permeability two orders of magnitude less than the permeability of the untreated fill at 2.33E-07 cm/sec. Replicates B and C were one order of magnitude less than the permeability of the untreated fill at 3.47E-06 and 4.92E-06 cm/sec, respectively. None of the replicates attained the criteria of 1E-08 cm/sec.
- 104. <u>Vendor 6.</u> The average permeabilities were 1.79E-05, 7.45E-06, and 6.36E-06 cm/sec for replicates A, B, and C, respectively. All permeability readings were greater than 1E-08 cm/sec. The reduction in permeability due to treatment was approximately one order of magnitude.
- 105. <u>Vendor 7.</u> The average permeabilities for replicates A, B, and C were 1.17E-05, 9.98E-07, and 1.34E-06 cm/sec, respectively. Compared to the

untreated fill, the Vendor 7 S/S process reduced the permeability of the fill by one order of magnitude. The average permeability of the three replicates was 4.68E-6 cm/sec. None of the replicates was permeable at the rate of 1E-08 cm/sec or less.

106. <u>Vendor 8.</u> The average permeabilities of replicates A and C were 1.15E-07 and 3.00E-06 cm/sec, respectively. The operator was unable to saturate replicate B with water and was therefore unable to record permeability readings for that replicate. None of the replicates had permeabilities less than 1E-08 cm/sec, and the Vendor 8 treatment process did not reduce the permeability by two orders of magnitude.

Bulk density

107. The bulk density was measured in triplicate for each replicate, and the results are presented in Appendix C.

Volumetric change

108. Based on the bulk density of the treated material and the Proctor density of the untreated fill, the volumetric change caused by the addition of binders was calculated and the results are summarized in Table 10 and presented in Figure 8. The volumetric change was calculated using Equations 5-7 below.

$$V_1 = \frac{W_g}{D_i} \tag{5}$$

where

 V_1 = volume of fill/clay

 W_s - weight of fill/clay

 D_1 - Proctor density of the untreated fill/clay

$$V_2 = \frac{(W_s + R \times W_s)}{D_2} \tag{6}$$

Table 10

Results of Volumetric Change Calculations for the Fill

		Bulk Density	Volumetric
<u>Vendor</u>	Replicate	lb/ft ³	Increase, %
*	A	86	
	В	84	
	С	78	
1	A	149	15
	В	148	13
	B C	143	21
2	A	125	44
	В	121	56
	B C	129	52
3	A	116	74
	В	121	69
	С	125	72
4	A	106	89
	В С	160	99
	С	98	99
5	A	109	99
	В	111	98
	С	110	95
6	Α	109	68
	В	112	64
	С	113	61
7	Α	123	70
	В	123	70
	С	123	68
8	A	117	93
	B C	116	95
	С	117	90

^{*} Untreated fill.

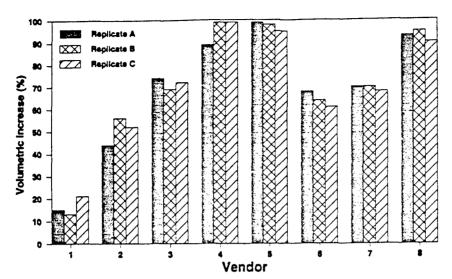


Figure 8. Volumetric change due to the addition of additives for FHC fill

where

 V_2 - volume of binder and fill/clay

R = binder-to-soil ratio (BSR)

 D_2 - bulk density of fill/clay and binder

- 109. It should be noted that the volumetric increases are substantially higher than those reported in the literature. This results from the use of the Proctor density as the baseline for measuring the volumetric increase.
- 110. <u>Untreated fill.</u> The Proctor density for the untreated fill was 149.7, 150.3, and 148.4 lb/ft³ for replicates A, B, and C, respectively. The bulk density for the untreated fill was 86.4, 84.2, and 77.8 lb/ft³ for replicates A, B, and C, respectively.
- 111. <u>Vendor 1.</u> The Vendor 1 process increased the volume for replicates A, B, and C by 15, 13, and 21 percent, respectively. Compared to the remaining vendors, Vendor 1's process produced the smallest volumetric increase in the fill.

- 112. <u>Vendor 2</u>. The Vendor 2 process increased the volume required for the treatment of the fill due to the addition of cement and a chemical reducing agent. The volumetric increases for the average bulk densities were 44, 56, and 52 percent, for replicates A, B, and C, respectively.
- 113. <u>Vendor 3</u>. Vendor 3 increased the volume of the fill through the addition of additives by 74, 69, and 72 percent, for replicates A, B, and C, respectively, based on average bulk densities.
- 114. <u>Vendor 4.</u> Vendor 4 added cement, a metal complex reagent, and a cementitious reagent, causing an 89-, 99-, and 99-percent volumetric increase for replicates A, B, and C, respectively. The addition of binders approximately doubled the volume of the fill.
- 115. <u>Vendor 5.</u> Vendor 5 doubled the volume of the fill by adding cement and sodium silicate. The volumetric increase was 99, 98, and 95 percent for replicates A, B, and C, respectively, representing the greatest volumetric increase for the fill among the vendors.
- 116. <u>Vendor 6</u>. Vendor 6 had volumetric increases of 68, 64, and 61 percent for replicates A, B, and C, respectively.
- 117. <u>Vendor 7.</u> Vendor 7 produced volumetric increases of 70, 70, and 68 percent for replicates A, B, and C, respectively, on the basis of average bulk densities. Vendor 7 added an ASR of 0.30 fly ash to the fill that may have contributed greatly to the volume increase.
- 118. <u>Vendor 8.</u> Vendor 8 approximately doubled the volume required for treatment of the fill. The volumetric increases for replicates A, B, and C were 93, 95, and 90 percent, respectively. The volumetric increase may be largely attributed to the 0.40 ASR for blast furnace slag added to the fill. <u>Slump</u>
- 119. The slump was measured for each replicate of the fill immediately after the mixing process was complete. When two consecutive tests showed a falling away characteristic, the mixture lacked cohesiveness. Thus, the slump test was not applicable. The results of the slump test are presented in Appendix C and discussed below.
- 120. Vendor 1 slumps for replicates A, B, and C were 7, 0, and 1.25 in., respectively. Replicate B showed the least slump, which may be related to no water being added to the replicate mixture. Slumps of 0 in. were calculated for all replicates of mixtures from Vendors 2, 3, 4, and 7. Vendor 5 slumps were measured for replicates A, B, and C and were 8, 6.5, and 7.25 in., respectively, and Vendor 8 slumps were 1.25, 0.25, and 0 in. for

replicates A, B, and C, respectively. Vendor 6 mixtures were not free-standing, and slump measurements were not available.

Moisture results

121. The results of moisture content tests conducted on the treated fill are presented in Appendix C. Moisture tests were performed in triplicate for each replicate of the treated fill after 28 days of cure.

122. The results of the set time conducted on the treated fill after 2, 4, 8, 24, and 48 hr of cure are presented in Appendix C. CI readings were taken in triplicate for each curing time.

Specific gravity

123. The specific gravities were measured in triplicate for the treated fill after 28 days of cure and are presented in Appendix C.

Bleed water

Set time

124. Vendor 1's specimens had a layer of free water approximately 2 mm thick on the surface of replicate A for the fill. Vendor 5 had a layer of free water approximately 1 mm in thickness on the surface of the fill specimens. The Vendor 3, 7, and 8 specimens had a layer of free water approximately 1 mm thick on the surface of the fill specimens. Specimens prepared by the remaining vendors (Vendors 2, 4, and 6) did not have a layer of free water on their surface.

Cracking

125. Vendor l's specimens did not have cementitious properties. The replicate C specimens deformed when extruded from the molds. One specimen of replicate C for the fill prepared by Vendor 2 was cracked around the middle and broke in half during dimensional measurements. Specimens from Vendors 3 and 4 had small voids in each of the replicates for the fill. Vendor 5's specimens had cracks in three replicates for the fill. Vendor 7's specimens had voids in each of their replicates for the fill. The Vendor 8 specimens had cracks approximately 2 to 3 mm in length on three replicate fill specimens.

Results of Contaminant Release Testing

MWEP-1 results

126. The results of the mean total chromium and Cr(VI) concentrations in the MWEP-1 for treated and untreated fill for each vendor S/S process are

presented in Appendix C. Figure 9 represents the MWEP-1 concentrations for total chromium, and Figure 10 represents the MWEP-1 results for Cr(VI).

- 127. Untreated fill. The results of the MWEP-1 run on the untreated fill were above the 0.05-mg/L drinking water standard for total chromium by a factor of 10. Triplicate analyses of the MWEP-1 extracts provided a mean total chromium concentration of 0.40 mg/L. The mean Cr(VI) concentration was 0.35 mg/L. The majority of the total chromium MWEP-1 concentration exists as Cr(VI).
- 128. <u>Vendor 1.</u> Mean concentrations for Cr(VI) and total Cr were <0.029 and 0.115 mg/L, respectively. The total chromium concentration was twice the 0.05 mg/L standard assigned to MWEP-1 leachates for total chromium.
- 129. Vendor 2. Mean concentrations for Cr(VI) and total Cr were 0.147 mg/L, meaning the Cr existed as Cr(VI). The total Cr concentration tripled the 0.05-mg/L drinking water standard designated in the remedial design objectives.
- 130. <u>Vendor 3.</u> The mean Cr(VI) and total Cr concentrations were 0.073 and 0.078 mg/L, respectively. Most of the Cr exists in the extract as Cr(VI). Total Cr concentrations were above the 0.05-mg/L criterion as a result of the presence of Cr(VI).
- 131. Vendor 4. The mean Cr(VI) and total Cr concentrations were 0.12 and 0.13 mg/L, respectively. Total Cr concentration exceeded the 0.05-mg/L criterion as a result of the presence of Cr(VI).
- 132. Vendor 5. The mean Cr(VI) and total Cr concentrations were 0.099 and 0.10 mg/L, respectively. Most of the total Cr present was in the form of Cr(VI). The total Cr concentration was twice the 0.05-mg/L criterion.
- 133. <u>Vendor 6.</u> The mean Cr(VI) and total Cr concentrations were 0.12 and 0.11 mg/L, respectively. The total Cr was twice the 0.05-mg/L criterion. The bulk of the total Cr was in the form of Cr(VI).
- 134. Vendor 7. The mean concentrations of Cr(VI) and total Cr in the MWEP-1 extracts were 0.11 and 0.10 mg/L, respectively. The mean concentration of Cr(VI) exceeded the mean total Cr concentration. One replicate Cr(VI) concentration exceeded the total Cr concentration by 0.033 mg/L, causing a greater mean Cr(VI) concentration. The total Cr was present in the form of Cr(VI). Total Cr in the MWEP-1 extract exceeded the drinking water standard of 0.05 mg/L.

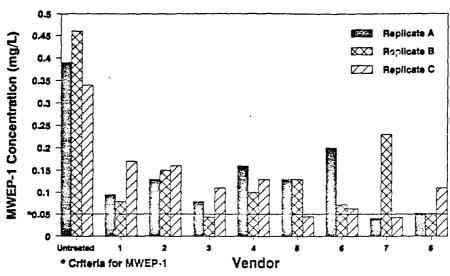


Figure 9. Results of MWEP-1 concentrations of total chromium in treated and untreated fill

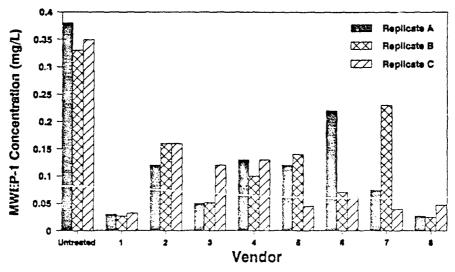


Figure 10. Results of MWEP-1 concentrations of Cr(VI) in treated and untreated fill

135. <u>Vendor 8.</u> The mean Cr(VI) concentration in the MWEP-1 extract was <0.033 mg/L. The mean total Cr concentration was 0.071 mg/L. Two replicates had concentrations of 0.051 and 0.052 mg/L, only slightly higher than the 0.05-mg/L criterion. Total Cr concentration exceeded the 0.05-mg/L criterion established in the remedial design objectives. Most of the Cr present in the MWEP-1 extract was in the form of Cr(III).

TCLP results for fill

- 136. The mean concentrations of total chromium and Cr(VI) in the TCLP conducted on treated and untreated FHC fill are presented in Appendix C and discussed below. Figures 11 and 12 represent the results of the TCLP for total chromium and Cr(VI).
- 137. Untreated fill. The criterion for total chromium concentration in TCLP leachates is 5.0 mg/L (40 CFR 261). The concentration of total chromium in the replicates was 0.16, 0.16, and 0.081 mg/L, with a mean of 0.13 mg/L. Cr(VI) concentrations were all <0.020 mg/L. The replicate total chromium and Cr(VI) concentrations were all below the 5.0-mg/L criterion for total chromium.
- 138. <u>Vendor 1.</u> The replicate total chromium concentrations in the Vendor 1 leachates were 2.0, 2.3, and 2.2 mg/L. The mean total chromium concentration in the TCLP leachates was 2.2 mg/L. Cr(VI) concentrations of the replicates were <0.020 mg/L. The chromium present was in the trivalent form.
- 139. Vendor 2. The replicate total chromium TCLP concentrations in the Vendor 2 leachates were 0.049, 0.065, and 0.026 mg/L. The replicate Cr(VI) concentrations were 0.028, 0.038, and <0.020 mg/L. The TCLP concentrations were below the 5.0-mg/L criterion for chromium in the TCLP.
- 140. Vendor 3. The concentrations of Cr(VI) in the TCLP conducted on the treated fill were 0.068, 0.058, and 0.050 mg/L. The concentrations were below the criterion of 5.0 mg/L. The total chromium concentrations were 0.079, 0.032, and 0.062 mg/L.
- 141. <u>Vendor 4.</u> The mean total chromium concentration for the replicates was 0.12 mg/L. The replicate concentrations were below the 5.0 -mg/L criterion. The chromium present in the leachates was in the trivalent form, shown by concentrations of Cr(VI) of <0.020, <0.020, and 0.042 mg/L.
- 142. <u>Vendor 5.</u> The concentrations of total chromium in the TCLP were 0.62, 0.63, and 0.33 mg/L. The concentrations of Cr(VI) were 0.61, 0.67, and 0.32 mg/L. The chromium present was in the hexavalent form.

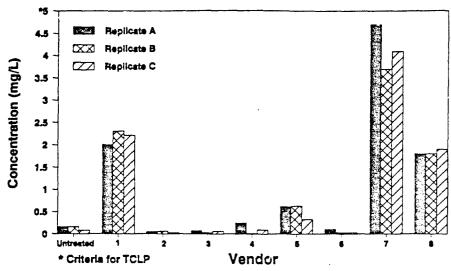


Figure 11. Results of TCLP concentrations of total chromium in treated and untreated fill

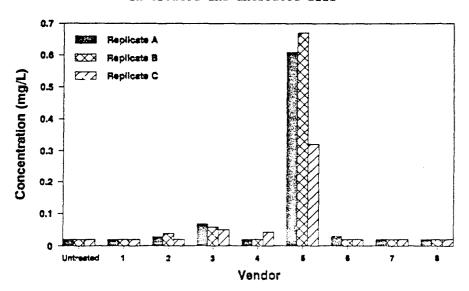


Figure 12. Results of TCLP concentrations of Cr(VI) in treated and untreated fill

- 143. <u>Vendor 6.</u> The concentrations of total chromium were 0.11, 0.028, and 0.032 mg/L. Two replicate concentrations of Cr(VI) were <0.020 mg/L, and the other replicate concentration was 0.033 mg/L. The concentrations of chromium in the TCLP were all less than 5.0 mg/L.
- 144. <u>Vendor 7.</u> The concentrations of Cr(VI) were all <0.020 mg/L. The concentrations of total chromium were 4.7, 3.7, and 4.1 mg/L. Chromium is present in the trivalent form. The total chromium concentrations were below the 5.0-mg/L criterion.
- 145. <u>Vendor 8.</u> The Cr(VI) concentrations were all <0.020 mg/L. The total chromium concentrations were 1.8, 1.8, and 1.9 mg/L. Chromium was present as Cr(III). The mean total chromium concentration was 1.8 mg/L, and all concentrations were <5.0 mg/L.

Effects of Dilution on Leaching

MWEP-1 results for fill

- 146. <u>Untreated fill</u>, The mean NMLC for total chromium and Cr(VI) was 5.01 and 4.48 mg/kg, respectively. Based on the NMLCs for MWEP-1 conducted on the fill for total chromium and Cr(VI), the efficiency of the treatment processes was evaluated.
- 147. <u>Vendor 1.</u> The mean normalized mass total chromium leached (MNMTCL) in the MWEP-1 was 1.742 mg/kg, 65 percent less than the MNMTCL in the mean MWEP-1 for the untreated fill. Normalization of the MWEP-1 Cr(VI) concentrations presented Cr(VI) leached at a mean of 0.443 mg/kg, representing a 90-percent reduction in the mean normalized mass Cr(VI) leached (MNMCSL) compared to the untreated fill.
- 148. <u>Vendor 2.</u> The MNMTCL in the MWEP-1 presented was 59 percent less than the MNMTCL in the MWEP-1 conducted on the untreated fill, and the MNMCSL was reduced by 54 percent compared to the untreated fill.
- 149. <u>Vendor 3.</u> Reductions of 75 and 74 percent were noted for MNMTCL and MNMCSL, respectively, from the MWEP-1 conducted on the treated fill in comparison with the MWEP-1 conducted on the untreated fill. The reduction in total chromium was mainly a representation of reduction in Cr(VI).
- 150. Vendor 4. The Vendor 4 S/S process reduced the MNMTCL concentration by 54 percent for total chromium and the MNMCSL by 52 percent for Cr(VI) compared to the untreated fill. The reduction of 54 percent of leachable total chromium was mainly represented by a reduction of leachable Cr(VI).

- 151. <u>Vendor 5.</u> There was a 63-percent reduction in the leachable total chromium based upon the MNMTCLs for treated and untreated fill. The MNMCSL was reduced by 59 percent, based on the MNMCSL for the untreated fill and the fill treated by Vendor 5.
- 152. Vendor 6. The mean NMLC for the fill was 1.905 mg/kg total chromium and 1.992 mg/kg Cr(VI). Compared to the mean NMLC for the untreated fill, the Vendor 6 efficiency for total chromium was 62 percent and for Cr(VI), 56 percent.
- 153. Vendor 7. The mean NMLC for the total chromium was 1.734; the mean NMLC Cr(VI) was 1.896 mg/kg. The MNMTCL was reduced by 65 percent, and the MNMCSL by 58 percent.
- 154. Vendor 8. The mean NMLC for total chromium and Cr(VI) was 1.291 and 0.601, respectively. The Vendor 8 process reduced the MNMTCL by 74 percent and the MNMCSL by 87 percent.

TCLP results

- 155. Normalization of the TCLP results was calculated according to the methods described for normalization of the MWEP-1 in paragraph 68, and the results are presented in Appendix C for the fill.
- 156. Untreated fill. The mean NMLC, which represents the normalized amount of total chromium and Cr(VI) leached, was 3.377 and 0.507 mg/kg, respectively. The NMLC for Cr(VI) is based on the detection limit of <0.020 mg/L. Based on the NMLCs for total chromium and Cr(VI), the efficiency of the treatment processes for each vendor was calculated.
- 157. <u>Vendor 1.</u> The Vendor 1 process represented an increase in the MNMTCL of 1,806 percent and an increase in the MNMCSL of 17 percent based on the MNMTCL of 64.358 mg/kg and the MNMCSL of 0.047 mg/kg. The MNMCSL was calculated based on the concentration for all replicates of <0.020 mg/L.
- 158. <u>Vendor 2.</u> Vendor 2's process efficiency for the MNMTCL was 61 percent based on a MNMTCL of 1.317 mg/kg; the MNMCSL was increased by 60 percent based on a MNMCSL of 0.809 mg/kg.
- 159. Vendor 3. The mean NMLCs for total chromium and Cr(VI) were 1.841 and 1.885 mg/kg, respectively. Vendor 3 reduced the MNMTCL by 45 percent but increased the MNMCSL by 272 percent.
- 160. Vendor 4. The mean NMLC for total chromium was 4.299 mg/kg, and the mean NMLC for Cr(VI) was 0.965 mg/kg. Based on the NMLCs, Vendor 4 increased the MNMTCL in the TCLP by 27 percent and increased the MNMCSL by 90 percent.

- 161. <u>Vendor 5.</u> Compared to the untreated fill, Vendor 5 increased the total chromium leached in the TCLP by 472 percent and increased the Cr(VI) in the TCLP by 3,760 percent. The MNMTCL was 19.310 mg/kg, and the MNMCSL was 19.553 mg/kg. The chromium present was in the form of Cr(VI).
- 162. <u>Vendor 6.</u> The mean NMLCs for total chromium and Cr(VI) were 1.932 and 0.827 mg/kg, respectively. The Vendor 6 process reduced the MNMTCL by 43 percent for total chromium and increased the MNMCSL by 63 percent for the Cr(VI).
- 163. <u>Vendor 7.</u> The MNMTCL was 136.684 mg/kg, and the MNMCSL was 0.656 mg/kg. The MNMCSL was calculated from the concentration of 0.020 mg/L based on the detection limit. The process produced a 3,947-percent increase in the MNMTCL and an increase in the MNMTCL and an increase in the MNMCSL of 29 percent.
- 164. <u>Vendor 8.</u> The Vendor 8 process produced an increase in the MNMTCL of 1,879 percent and an increase in the MNMCSL of 44 percent based on a MNMTCL of 66.815 mg/kg and a MNMCSL of 0.729 mg/kg. All Cr(VI) concentrations were below the detection limit, <0.020 mg/L. The detection limit was the basis for a calculation of the MNMCSL.

Standard Deviation and Relative Standard Deviation

165. Standard deviation was calculated for the fill and clay from the following equation:

$$s = \sqrt{\frac{\sum (x_i - x)^2}{n - 1}}$$
 (8)

where

s - standard deviation of n observations

 x_i - observation

x - mean of the observations

n - number of bservations

166. The relative standard deviation DD) was calculated from the following equation:

MWEP - total chromium

- 167. <u>Untreated.</u> The NMLCs for the untreated fill were 5.00, 5.68, and 4.36 mg/kg for replicates A, B, and C, respectively. Based on the NMLC, the standard deviation was 0.661 and the RSD was 13 percent for the fill.
- 168. <u>Vendor 1.</u> Vendor 1 varied the amount of additive used among its replicates; therefore, precision of the results must be based on the NMLC. The NMLC for the fill was 1.38, 1.10, and 2.75 mg/kg for replicates A, B, and C, respectively. The standard deviation of the NMLC for fill was 0.883. The MWZP-1 concentrations for the treated fill had an average precision of 51 percent based on NMLC calculations.
- 169. <u>Vendor 2.</u> The NMLCs for replicates A, B, and C were 1.84, 2.11, and 2.27 mg/kg, respectively. Precision of the NMLC for the fill was 11 percent. The standard deviation of the NMLC calculated for the fill was 0.22.
- 170. <u>Vendor 3.</u> The NMLCs were 1.24, 0.73, and 1.75 mg/kg for replicates A, B, and C, respectively. The NMLC standard deviation for the fill was 0.51. Based on the NMLC, the precision of the fill was 41 percent.
- 171. <u>Vendor 4.</u> The NMLCs for replicates A, B, and C were 2.92, 1.76, and 2.26 mg/kg, respectively. The NMLC standard deviation for the fill was 0.58, and the NMLC RSD was 25 percent.
- 172. <u>Vendor 5.</u> The NMLCs for replicates A, B, and C were 2.33, 2.39, and 0.86 mg/kg, respectively. Vendor 5's NMLC standard deviation for the fill was 0.87, and the NMLC RSD was 47 percent. One replicate had a concentration one order of magnitude less than the other two replicates, causing the RSD to be increased.
- 173. <u>Vendor 6.</u> The NMLCs for replicates A, B, and C were 3.44, 1.26, and 1.02 mg/kg, respectively. The NMLC standard deviation for the fill was 1.33, and the NMLC RSD based on the mean NMLC concentration was 70 percent. The highest fill concentration was 0.20 mg/L; the other concentrations were 0.072 and 0.063 mg/L, causing a higher NMLC RSD.
- 174. <u>Vendor 7.</u> The NMLCs for the fill replicates were 0.68, 3.84, and 0.68 mg/kg. The NMLC standard deviation was 1.82 with a NMLC RSD of 105 percent. The NMLC RSD was >100 percent due to one concentration being one order of magnitude greater than the other concentrations.

- 175. <u>Vendor 8.</u> One concentration of the fill was 0.11 mg/L, approximately twice the concentration of the other replicates (0.052 and 0.051 mg/L). The NMLC standard deviation was 0.60, and the NMLC RSD was 47 percent.

 MWEP chromium (VI)
- 176. Untreated. The NMLCs were 4.87, 4.08, and 4.49 mg/kg, respectively, for replicates A, B, and C. The NMLC standard deviation was 0.398, and the NMLC RSD was 9 percent.
- 177. <u>Vendor 1.</u> The NMLCs were <0.44, <0.37, and <0.52 mg/kg, respectively, for replicates A, B, and C. The NMLC standard deviation, calculated based on the detection limit, was 0.072; the NMLC RSD was 16 percent.
- 178. <u>Vendor 2.</u> The NMLCs for the replicates were 1.70, 2.25, and 2.27 mg/kg. The NMLC standard deviation was 0.33 with an NMLC RSD of 16 percent.
- 179. <u>Vendor 3.</u> The NMLCs for the replicates were 0.76, 0.84, and 1.91 mg/kg, with an NMLC standard deviation of 0.64 and NMLC RSD of 55 percent. One concentration was double the other two concentrations, causing the NMLC RSD to be 55 percent.
- 180. Vendor 4. The concentrations of the Cr(VI) in the fill were 0.13, 0.10, and 0.13 mg/L. The NMLCs for the replicates were 2.38, 1.76, and 2.26 mg/kg. Based on the NMLC concentrations, the standard deviation was 0.33 and the NMLC RSD was 15 percent.
- 181. Vendor 5. The NMLCs for the replicates were 2.15, 2.57, and 0.84~mg/kg. The NMLC standard deviation for the fill was 0.90, and the NMLC RSD was 49 percent. One concentration was one third less than the other two, causing the NMLC RSD to be 49 percent.
- 182. <u>Vendor 6.</u> Vendor 6's NMLC standard deviation was 1.55, and the NMLC RSD was 78 percent. The NMLCs were 3.78, 1.22, and 0.98 mg/kg. One concentration was considerably higher than the other two, causing an NMLC RSD of 78 percent.
- 183. Vendor 7. One concentration among the replicates was one order of magnitude greater than the other concentrations, causing a relatively high NMLC RSD. The NMLCs were 1.23, 3.84, and 0.62 mg/kg. The NMLC standard deviation was 1.55, and the NMLC RSD was 78 percent.
- 184. <u>Vendor 8.</u> Two concentrations for the fill were <0.027 and <0.025 mg/L; the other concentration was 0.047 mg/L. The NMLC were calculated based on the detection limit listed for that concentration and were 0.51,

based on the letection limit listed for that concentration and were 0.51, 0.45, and 0.85 mg/kg. The NMLC standard deviation was 0.218 mg/L, and the NMLC RSD was 36 percent.

TCLP - total chromium

- 185. <u>Untreated.</u> The total chromium concentrations for the fill were 0.160, 0.160, and 0.081 mg/L and were normalized to 4.102, 3.952, and 2.077 mg/kg, respectively. The NMLC standard deviation was 1.129, and the NMLC RSD was 33 percent.
- 186. <u>Vendor 1.</u> The NMLC standard deviation for the fill was 6.5. The NMLC RSD for the fill was 10 percent. The concentrations for the fill were within 0.3 mg/L among replicates, providing an NMLC RSD of 10 to 11 percent. The NMLCs were 58.12, 63.83, and 71.13 mg/kg.
- 187. <u>Vendor 2.</u> The fill NMLCs were 1.385, 1.827, and 0.738 mg/kg for the replicates, providing an NMLC standard deviation of 0.547 and an NMLC RSD of 42 percent.
- 188. <u>Vendor 3.</u> The NMLCs for the fill were 2.49, 1.058, and 1.976 mg/kg. Based on the NMLC concentrations, the NMLC RSD was 39 percent.
- 189. <u>Vendor 4.</u> One of the replicate concentrations was one order of magnitude greater than the other replicates. The NMLC concentrations were 9.14, 0.493, and 3.266 mg/L with an NMLC RSD of 103 percent.
- 190. <u>Vendor 5.</u> The concentrations of total chromium in the TCLP conducted on the fill were 0.62, 0.63, and 0.33 mg/L. The NMLC was 22.21, 23.13, and 12.60 mg/kg, respectively, with a standard deviation of 5.83 and an NMLC RSD of 30 percent.
- 191. <u>Vendor 6.</u> The concentrations of total chromium in the fill replicates were 0.11, 0.028, and 0.032 mg/L and were normalized to 3.78, 0.98, and 1.04 mg/kg, respectively. Based on the NMLC, the standard deviation was 1.60 and the NMLC RSD was 83 percent. One concentration (0.11 mg/L) was approximately four times the other replicates, causing a high NMLC RSD.
- 192. <u>Vendor 7.</u> The concentrations of total chromium in the fill were 4.7, 3.7, and 4.1 mg/L and were normalized to 156.60, 123.50, and 129.95 mg/kg, respectively. Based on the NMLC, the standard deviation was 17.55 and the RSD was 13 percent.
- 193. <u>Vendor 8.</u> For the fill, the concentrations of total chromium were 1.8, 1.8, and 1.9 mg/L. These concentrations were normalized to 67.5, 64.3, and 68.7 mg/kg, respectively, with an NMLC standard deviation of 2.3 and an NMLC RSD of 3 percent.

TCLP - chromium (VI)

- 194. <u>Untreated.</u> The concentrations of Cr(VI) in the fill were <0.020 mg/L for all replicates. Based on the detection limit of 0.020 mg/L, the NMLCs were calculated as 0.513, 0.494, and 0.513 mg/kg. The NMLC standard deviation for the fill was 0.011, and the NMLC RSD was 2 percent.
- 195. <u>Vendor 1</u>, The concentrations of Cr(VI) for the fill were all <0.020 mg/L. The NMLCs were 0.581, 0.555, and 0.647 mg/kg, respectively, with an NMLC standard deviation of 0.047 and an NMLC RSD of 8 percent.
- 196. Vendor 2. The concentrations of Cr(VI) in the fill were 0.028, 0.038, and <0.020 mg/L. Vendor 2 mobilized Cr(VI) based on the concentrations in the untreated fill and clay. Based on the concentrations in the fill, the NMLCs were 0.792, 1.068, and 0.568 mg/kg with a standard deviation of 0.251 and an NMLC RSD of 31 percent.
- 197. <u>Vandor 3.</u> Based on the concentrations of Cr(VI) in the untreated fill, Vendor 3 mobilized Cr(VI). The concentrations of Cr(VI) in the fill replicates were 0.068, 0.058, and 0.05 mg/L, corresponding to NMLCs of 2.143, 1.918, and 1.593 mg/kg, respectively. The standard deviation of the NMLCs were 0.276, and the NMLC RSD was 15 percent.
- 198. <u>Vendor 4.</u> For the fill, two replicate concentrations were <0.020 mg/L and the other replicate concentration was 0.042 mg/L. Normalization of the concentrations presented 0.731, 0.704, and 1.459 mg/kg of Cr(VI) leached, with a standard deviation of 0.429 and an NMLC RSD of 44 percent.
- 199. <u>Vendor 5.</u> The concentrations of Cr(VI) in the fill TCLP extracts were 0.61, 0.67, and 0.32 mg/L and were normalized to 21.85, 24.60, and 12.21 mg/kg, respectively. Based on the NMLCs, the standard deviation was 6.50 and the NMLC RSD was 33 percent.
- 200. Vendor 6. The NMLCs for the fill replicates were 1.134, 0.697, and 0.651 mg/kg with a standard deviation of 0.267 and an NMLC RSD of 32 percent. Two concentrations in the fill leachates were <0.020 mg/L, and the other concentration was 0.030 mg/L. NMLC concentrations were calculated based on the detection limit of 0.020 mg/L for the two replicates.
- 201. <u>Vendor 7.</u> The concentrations of Cr(VI) in the fill leachates were all <0.020 mg/L. Normalization was based on 0.020 mg/L for the fill, and the NMLCs were 0.666, 0.668, and 0.634 mg/kg with a standard deviation of 0.019 and an NMLC RSD of 3 percent.
- 202. Vendor 8. The Vendor 8 concentrations in the TCLP extracts for the fill were all <0.020 mg/L. NMLCs were calculated based on a concentration

of 0.020 mg/L. Based on the NMLCs for the fill, the standard deviation was 0.019 and the NMLC RSD was 3 percent.

Analysis of variance for MWEP-1 and TCLP

203. MWEP-1. The results of an ANOVA conducted on the MWEP-1 for the fill are presented in Table 11. The ANOVA on the MWEP-1 showed two groups: the untreated MWEP-1 data and the data of the samples treated by the vendors. The MWEP-1 conducted on the untreated fill is significantly different from the treated fill.

204. TCLP. The results of an ANOVA conducted on the TCLP for the fill are presented in Table 11. For the fill, an ANOVA conducted on the TCLP data provided four groups of data that are different. Vendor 7's TCLP is different from the remaining vendors. Vendor 5 is significantly different from the remaining vendors. Vendors 8 and 1 are not significantly different, but Vendors 7, 8, and 1 are different from the remaining vendors.

Table 11

Results of ANOVA for TCLP and MWEP-1 for the Fill

	Mean NMLC	
Vendor	mg/kg	Group
	MWEP-1	
*	6.420	1
4	2.314	2
2	2.072	2
4	1.905	2
5	1.858	2
1	1.742	2
7	1.734	2 2 2 2 2 2 2 2
8 3	1.291	2
3	1.242	2
	TCLP	
7	136.684	1
8	66.815	2
1	64.358	2 2
5	19.310	3
*	5.013	4
4	4.299	4
6	1.932	4
3	1.841	4
3 2	1.317	4

^{*} Untreated fill.

PART IV: DISCUSSION OF RESULTS FOR CLAY MATERIAL TESTING

Analysis of Homogenization

205. A major concern during the conduct of the study was the use of a homogenized sample for the application of the S/S processes. An attempt was made to provide each vendor with a statistically homogeneous sample. The homogeneity of the samples was evaluated by normalizing the total chrome for dilution effects of binder addition and by conducting an ANOVA on the normalized chromium values.

Normalization process

206. Normalized mass leached concentration chromium values, which were calculated to compensate for the dilution effects of adding water and binder to the clay, are presented in Appendix E. Normalization of the bulk analysis was calculated for the untreated and treated clay using Equations 1 and 2. The results of the normalization of total chromium and Cr(VI) for bulk chemistry are presented in Table 12.

Analysis of variance

207. The results of the ANOVA conducted on the clay are presented in Table 13. The ANOVA presents five groups that are significantly different. Vendor 6's sample was different compared to the remaining vendors and was the highest in total chromium (5,140 mg/kg). The samples from Vendors 5 and 4 were not significantly different and had normalized total chromium values of 4,390 and 3,767 mg/kg, respectively. The third group contains Vendors 2, 1, and 7 and the untreated clay, and are not significantly different with normalized total chromium concentrations of 2,944, 2,633, 2,440, and 2,386 mg/kg, respectively. The normalized total chromium values for Vendors 8 and 3 were 2,125 and 1,830 mg/kg, respectively. The fourth group contains the untreated clay and Vendors 7, 1, and 8; the fifth group contains Vendors 7, 8, 1, and 3.

Chrome Reduction Study

208. The results of the WES CRS are presented in Table 14 and discussed below. Two additives were tested, BFS and ferrous sulfate, at varying dosages and reaction times of 0, 2, 4, 6, and 24 hours in triplicate.

Table 12

Results of Normalizing Total Chromium and Cr(VI) for

Treated and Untreated Frontier Hard Chrome Clay*

Vandar	Mean Total Cr	Norm. Total Cr	Mean Cr(VI) mg/kg	Norm. Cr(VI) mg/kg
Vendor	<u>_mg/kg</u> 2,633	mg/kg	10	<u></u>
1	1,867	2,386	0.014	0.017
2	2,267	2,944	7.3	9.5
3	1,167	1,830	6.9	10.7
4	2,467	3,767	8.4	12.6
5	2,267	4,390	8.4	13.5
6	3,567	5,140	3.6	9.0
7	1,300	2,440	3.2	0.20
8	1,267	2,125	0.140	0.10

^{*} Treatment objective was total chromium ≤0.05 mg/L.

Table 13

Results of Anova for Bulk Chemistry Conducted on Untreated Clay

Mean NMLC	
mg/kg_	Group
5,140	1
4,390	2
3,767	2
2,944	3
2,633	3,4
2,440	3,4,5
2,386	3,4,5
2,125	4,5
1,830	5
	mg/kg 5,140 4,390 3,767 2,944 2,633 2,440 2,386 2,125

^{*} Untreated clay.

^{**} Untreated clay.

Table 14

Results for the Chrome Reduction

Study Conducted on the Clay*

	Re	action Time	, hr	
	2_	4_	6	_24_
2.29	2.51	6.13	1.97	2.88
1.49	1.57	2.05	1.17	2.53
0.51	0.86	0.71	1.10	0.68
0.46	0.50	0.48	0.78	0.43
	3.45	2.25	2.87	3.30
6.38	2.98	3.23	2.65	4.53
4.11	2.07	3.63	2.55	2.00
1.93	2.20	2.39	1.94	3.93
	2.29 1.49 0.51 0.46	2.29 2.51 1.49 1.57 0.51 0.86 0.46 0.50 3.45 6.38 2.98 4.11 2.07	0 2 4 2.29 2.51 6.13 1.49 1.57 2.05 0.51 0.86 0.71 0.46 0.50 0.48 3.45 2.25 6.38 2.98 3.23 4.11 2.07 3.63	2.29 2.51 6.13 1.97 1.49 1.57 2.05 1.17 0.51 0.86 0.71 1.10 0.46 0.50 0.48 0.78 3.45 2.25 2.87 6.38 2.98 3.23 2.65 4.11 2.07 3.63 2.55

Note: Average Cr(VI) concentration in the untreated clay was 3.67 mg/kg. * Results are presented as mg/kg of Cr(VI).

Untreated clay

209. Triplicate analyses of the untreated clay were conducted to compare the treated and untreated results for reduction of Cr(VI). The average of the replicates was 3.67 mg/kg Cr(VI).

Blast furnace slag

210. The ASRs tested were 0.006, 0.12, 0.24, and 0.36. The lowest average concentration after 24 hr was 0.43 mg/L at an ASR of 0.36. BFS reduced Cr(VI) more effectively than ferrous sulfate and was selected as the additive for the detailed evaluation of clay at an ASR of 0.36.

Ferrous sulfate

211. Four ASRs were tested for ferrous sulfate. At the highest ASR, 0.0026, the average concentration was initially 1.93 mg/kg but reached 3.93 mg/kg after 24 hr. The other ASRs had average concentrations of 3.30, 4.53, and 2.00 mg/kg after 24 hr.

Initial Screening Test Results

212. The results of the initial screening test for the clay conducted by WES are summarized below. The detailed results are presented in Appendix A. Each time a stabilization process was applied, a batch of material was

generated. As shown, 8 batches of solidified clay were prepared for the cement and 15 batches were prepared for the lime/fly ash process.

Cement binder

- 213. Two WSRs and four ASRs were evaluated. After 8 hours, the 0.4 and 0.7 ASRs with a WSR of 0.1 had CI readings >750 psi. The 1.4/0.1 ASR/WSR mixture had CI measurements >750 psi after 1 hr. The 0.1/0.1 ASR/WSR mixture had an average CI reading of 487 psi after 24 hr. The 0.3 WSR produced CI values >750 psi for ASRs of 0.4, 0.7, and 1.4. A cement ASR of 0.1 with a WSR of 0.1 was selected for the preparation of specimens for detailed evaluation. Lime/fly ash binder
- 214. WSRs of 0.1 and 0.3 were evaluated in the initial screening test. Four ASRs were evaluated with each WSR. None of the ASR/WSR combinations provided average CI values >267 psi. Lime/fly ash treatment of the FHC clay was not evaluated further, and cement was selected as the binder to be evaluated in the detailed evaluation.

Results of Physical Testing of Clay Material

- 215. The results of tests on bulk density, Atterberg limits, Proctor density, UCS, permeability, specific gravity, and set time for the untreated clay are summarized in Table 15. The results of grain size and moisture content analyses for the clay are presented in Appendix D. UCS results
- 216. Measurements of UCS were performed in triplicate for each replicate after 28 days of cure. Figure 13 presents the results of the UCS tests conducted on the treated clay.
- 217. <u>Untreated clay.</u> The untreated clay specimens were prepared at Proctor density and allowed to cure for 28 days. The specimens fractured upon removal from the molds; therefore, UCS tests were not conducted.
- 218. <u>Vendor 1.</u> The Ensol/Landtreat process did not produce cementitious properties. Removal of the specimens from the molds damaged the specimens because there was no strength gain. No UCS measurements were taken.
- 219. <u>Vendor 2.</u> The average UCS values of replicates A, B, and C were 266, 271, and 200 psi, respectively. ASRs for the cement and chemical reducing agent varied slightly among replicates, possibly causing the UCS variability. Lower average UCS values for replicate C may be attributed to a smaller amount of cement addition. Replicates A and B had cement ASRs of 0.15, and

Table 15 Results of Physical Tests Conducted on Untreated Clay

		Replicate	
Parameter	1	2	3
Bulk density, pcf	97.2	101.5	105.8
Proctor density, pcf	134.1	137.2	134.1
Specific gravity	2.66	2,65	2.65
Resistance to penetration, psi*	50	47	48
Permeability, cm/sec*	N/A	N/A	3.95E-05
UCS, psi	N/A	N/A	N/A
Moisture, % dry weight**	46.13	46.14	47.14
Atterberg limits			
Plasticity index	24	25	27
Liquid limit	58	57	59
Plastic limit	34	32	32

^{*} Represents an average of three replicates. ** Represents an average of 33 replicates.

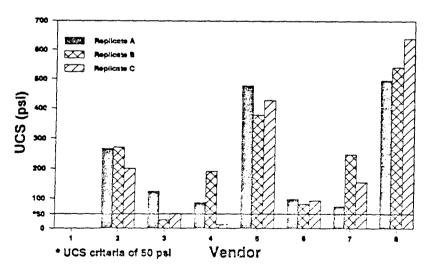


Figure 13. 28-day UCS results for FHC clay

replicate C had an ASR of 0.1 for cement. Replicate C had a larger ASR for the chemical reducing agent (0.1), while replicates A and B had an ASR of 0.08.

- 220. <u>Vendor 3.</u> The average UCS values for replicates A, B, and C were 124, 28, and 49 psi, respectively. One B replicate fractured when extruded from the mold. Vendor 3 was consistent in the addition of portland cement and silica to the replicates, but only replicate A developed strengths greater than 50 psi.
- 221. <u>Vendor 4.</u> The average UCS values for replicates A, B, and C were 86, 191, and 13 psi, respectively. Vendor 4 increased the ASRs for water with each replicate, from 0.21 to 0.23 to 0.26 for replicates A, B, and C, respectively. Replicates A and B had UCSs above the 50-psi criterion, but replicate C did not.
- 222. <u>Vendor 5.</u> The average UCS values for replicates A, B, and C were 478, 378, and 428 psi, respectively. Vendor 5 added 0.23 ASR of sodium silicate for replicate A and 0.20 ASR sodium silicate for replicates B and C. The cement ASR remained constant, and all replicates gained strengths greater than 50 psi.
- 223. <u>Vendor 6.</u> The average UCS values were 97, 81, and 93 psi, respectively. Vendor 6 was consistent in the ASRs added among replicates. All replicate UCSs were greater than 50 psi.
- 224. <u>Vendor 7.</u> The average UCS values for replicates A, B, and C were 74, 247, and 154 psi, respectively. The average UCS of replicate B was three times the average UCS of replicate A. The cement ASRs for replicates A and B were 0.07 and 0.10, respectively, possibly causing the difference in average UCS readings. All replicates had UCS values greater than 50 psi.
- 225. <u>Vendor 8.</u> The average UCS values were 496, 541, and 639 psi for replicates A, B, and C, respectively. Vendor 8 was consistent among replicates in the addition of ASRs and water, but the average UCS values varied by 143 psi from replicate A to replicate C. Vendor 8 specimens gained the greatest strengths among processes evaluated, and all UCS readings were >50 psi. Wet/dry results
- 226. To determine the durability of the specimens, the wet/dry test was conducted on three test specimens and three control specimens after 28 days of cure. The specimens were subjected to 12 cycles of wetting and drying, and the weight of the specimen was taken after each cycle to determine the loss during that cycle. Moisture contents were determined on one specimen in order

to evaluate the percent solids loss for the specimens. A total weight loss of 30 percent constitutes failure of the specimen (ASTM 1990). The average results of the wet/dry test for the clay are presented in Table 16. The detailed results by replicate are presented in Appendix E.

Table 16

Results of the Wet/Dry Tests Conducted
on Frontier Hard Chrome Clay

Vendor	ACCRML After 12 Cycles, g	Test Specimen (% Loss)	Control Specimen (% Loss)
1	NA	100	100
2	-0.31*	0.58	0.89
3	-0.22*	1.20	1.43
4	0.31	1.95	1.65
5	-0.20*	0.33	0.53
6	0.14	1.41	1.28
7	-0.15*	0.60	0.75
8	-0.04*	0.30	0.34
Goal	••	30	30

^{*} Negative result due to greater average relative mass loss in control sample than in treated sample.

- 227. <u>Vendor 1.</u> The specimens prepared by Vendor 1 did not have cementitious properties and failed the wet/dry test after one cycle. All of the specimens suffered 100 percent solid mass loss.
- 228. <u>Vendor 2.</u> The average percent solid mass loss from the test and control specimens was 0.58 percent and 0.89 percent, respectively. The specimens prepared by Vendor 2 passed 12 cycles of the wet/dry test. The ACCRML was -0.31 g, representing a greater mass loss from the controls than the test specimens.
- 229. <u>Vendor 3.</u> The average percent solid mass loss from the test and control specimens was 1.20 percent and 1.43 percent, respectively. Vendor 3's specimens had an ACCRML of -0.22 g. The specimens passed 12 cycles of the wet/dry test, with more sample mass loss from the controls than from the test specimens.

- 230. Vendor 4. The average percent solids loss from the test and control specimens was 1.95 percent and 1.65 percent, respectively. The test specimens lost more mass than the controls, which is represented by a positive ACCRML of 0.31 g. No specimens experienced a mass loss ≥30 percent, and the specimens passed 12 cycles of the wet/dry test.
- 231. <u>Vendor 5.</u> Vendor 5's test and control specimens passed 12 cycles of the wet/dry test. There was no significant loss of material from the specimens during the 12 wet/dry cycles. The average percent solids mass loss for the test and control specimens was 0.33 percent and 0.53 percent, respectively. The ACCRML for the specimens was -0.20 g, meaning there was a greater mass loss from the control specimens than the test specimens.
- 232. <u>Vendor 6.</u> The test specimens lost more mass than the control specimens, which is indicated by a positive ACCRML of 0.14 g. The test and control specimens' average percent solids mass loss was 1.41 percent and 1.28 percent, respectively. The test and control specimens passed 12 cycles of the wet/dry test.
- 233. <u>Vendor 7.</u> The ACCRML for the wet/dry specimens was -0.15 g. The average percent solid mass loss from the test and control specimens was 0.60 percent and 0.75 percent, respectively. More mass was lost from the control specimens than the test specimens, and the specimens passed 12 cycles of the wet/dry test.
- 234. <u>Vendor 8.</u> The Vendor 8 specimens had an average ACCRML of -0.04 g, indicating a greater mass loss from the control specimens than the test specimens. The average percent solid mass loss from the test and control specimens was 0.30 percent and 0.34 percent, respectively. The specimens passed 12 cycles of the wet/dry test.

Permeability results

- 235. The results of the permeability test conducted on the untreated and treated clay are summarized in Table 17 and illustrated in Figure 14. Triplicate readings were conducted on each replicate to obtain an average permeability after 28 days of cure. Detailed results of permeability testing are presented in Appendix E.
- 236. <u>Untreated clay.</u> The permeability specimens were prepared at Proctor density and allowed to cure for 28 days. Only one permeability specimen, replicate C, was cohesive enough for permeability testing, with a permeability of 3.95E-05 cm/sec. Replicates A and B fractured upon removal from the molds.

Table 17
Summary of Permeability Test Results for the Clay

<u>Vendor</u>	Replicate	Average Permeability cm/sec
*	A B C	NA NA 3.95E-05
1	A B C	7.56E-05 4.80E-07 1.43E-06
2	A B C	7.63E-06 2.61E-06 4.87E-06
3	A B C	8.67E-08 7.66E-07 7.38E-05
4	A B C	1.73E-05 6.01E-07 1.16E-06
3	A B C	9.54E-04 NA 1.57E-07
6	А В С	6.96E-06 2.43E-06 4.61E-07
7	A B C	4.30E-06 4.26E-07 6.63E-07
8	A B C	2.14E-07 1.61E-07 1.37E-06

Note: Permeability goal was 1E-08 cm/sec or two orders of magnitude less than untreated clay.

^{*} Untreated clay.

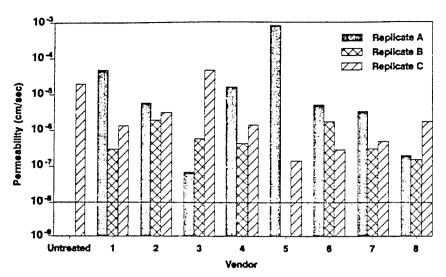


Figure 14. 28-day permeability results for FHC clay

- 237. <u>Vendor 1.</u> The average permeabilities of replicates A, B, and C were 7.56E-05, 4.80E-07, and 1.43E-06 cm/sec, respectively. The additions of water and binder to the clay varied among replicates, possibly causing the variance among the permeability readings. Treated replicate B had a permeability two orders of magnitude less than the permeability of the untreated clay replicate C. None of the permeabilities was less than 1E-08 cm/sec.
- 238. <u>Vendor 2.</u> The average permeabilities of Vendor 2's replicates were 7.63E-06, 2.61E-06, and 4.87E-06 cm/sec, for A, B, and C, respectively. The permeabilities of these specimens were one order of magnitude less than the untreated clay replicate permeability. None of the permeability readings was less than 1E-08 cm/sec.
- 239. Verdor 3. The first permeability reading for replicate A was 5.52E-08 cm/sec, five times the permeability goal of 1E-08 cm/sec. The average permeability of replicate A was 8.67E-08 cm/sec, approximately three orders of magnitude less than the permeability of the untreated clay. Replicate B had an average permeability two orders of magnitude less than the untreated permeability, but replicate C had an average permeability of 7.38E-05 cm/sec, twice the permeability of the untreated clay sample. None of the permeabilities was equal to or less than 1E-08 cm/sec, and replicate C was not two orders of magnitude less than the untreated clay.
- 240. Vendor 4. The average permeabilities of replicates A, B, and C were 1.73E-05, 6.01E-07, and 1.16E-06 cm/sec, respectively. The

permeabilities were consistent among replicates, but were not equal to or less than 1E-08 cm/sec, the goal for permeability of the treated clay, nor were the permeabilities two orders of magnitude less than the untreated clay permeability.

- 241. Vendor 5. The average permeabilities of replicates A and C were 9.54E-04 and 1.57E-07 cm/sec, respectively. The operator was unable to saturate replicate B; therefore, no permeability readings were recorded. The average permeability of replicate A was one order of magnitude greater than the permeability of the untreated clay, but the average permeability of replicate C was two orders of magnitude less than the permeability of the untreated clay. Vendor 5 representatives added more sodium silicate to replicate A (at a ratio of 0.23 g sodium silicate/g wet clay) than replicates B and C (at 0.20 g sodium silicate/g wet clay), which may explain the difference in permeabilities. However, Vendor 5 representatives added the same amounts of cement and sodium silicate to replicates B and C, but no permeability reading was recorded for replicate B.
- 242. <u>Vendor 6</u>. The average permeabilities of replicates A, B, and C were 6.96E-06, 2.43E-06, and 4.61E-07 cm/sec, respectively. One permeability reading on replicate C was two orders of magnitude less than the permeability of the untreated clay, and no permeability readings were less than or equal to 1E-08 cm/sec. The permeabilities did not meet the designated criterion.
- 243. <u>Vendor 7.</u> The average permeabilities for replicates A, B, and C were 4.30E-06, 4.26E-07, and 6.63E-07 cm/sec, respectively. The average permeability of replicate B was approximately two orders of magnitude less than the permeability of the untreated clay. The permeabilities among replicates remained consistent, but no individual permeabilities were less than or equal to 1E-08 cm/sec.
- 244. <u>Vendor 8.</u> The average permeabilities were 2.14E-07, 1.61E-07, and 1.37E-06 cm/sec for replicates A, B, and C, respectively. Two replicates, A and B, had permeabilities two orders of magnitude less than the permeability of the untreated clay, but the average permeability of replicate C was only one order of magnitude less than the permeability of the untreated clay. No permeability readings were equal to or less than 1E-08 cm/sec.

 Bulk density
- 245. The bulk density was measured in triplicate for each replicate, and the results are presented in Appendix E.

Volumetric change

246. Based on the bulk density of the treated material and the Proctor density of the untreated clay, the volumetric change caused by the addition of binders was calculated as described in the fill section. These results are summarized in Table 18 and represented in Figure 15.

247. Untreated clay. The Proctor densities of the untreated clay were 134.1, 137.2, and 134.1 lb/ft^3 , for replicates A, B, and C, respectively, and were the basis for volumetric increase calculations. The bulk densities of

Table 18

Results of Volumetric Change Calculations for the Clay

Vendor	Popliants	Bulk Density	Volumetric
	Replicate	lb/ft ³	Increase, %
*	A	97	
	В	102	
	С	106	
1	A	120	29
	В	126	28
	С	121	33
2	A	125	51
	A B C	121	56
	С	129	46
3	A	116	77
	В	121	79
	С	125	77
4	A	106	86
	В	100	63
	С	98	62
5	A	109	104
	В	111	102
	С	110	98
6	A	109	71
	В	1.12	79
	С	113	70
7	A	123	89
	B C	123	96
	С	123	95
8	A	117	87
	В	116	85
	С	117	84

^{*} Untreated clay.

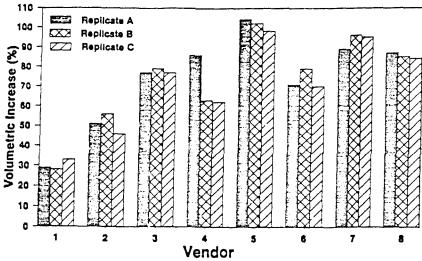


Figure 15. Volumetric change resulting from the addition of additives for FHC clay

the untreated clay were 97.2, 101.5, and 105.8 lb/ft^3 , for replicates A, B, and C, respectively, and were the basis for volumetric increase calculations.

- 248. <u>Vendor 1.</u> The volumetric increases for replicates A, B, and C were 29, 28, and 33 percent, respectively. Vendor 1 had the lowest volume increase of any of the vendors.
- 249. <u>Vendor 2.</u> The volumetric increase caused by the addition of additives for replicates A, B, and C were 51, 56, and 46 percent, respectively.
- 250. <u>Vendor 3</u>. The Vendor 3 process increased the volume based on the average bulk densities for replicates A, B, and C by 77, 79, and 77 percent, respectively.
- 251. <u>Vendor 4.</u> The volume increase for replicate A was 86 percent, and the volume increases for replicates B and C were 63 and 62 percent, respectively. The higher volume increase for replicate A may be attributed to any number of factors. The variable factor in the mixing process was a 0.21 WSR for replicate A and WSRs of 0.23 and 0.26 for replicates B and C, respectively.
- 252. <u>Vendor 5.</u> Vendor 5's process doubled the volume required for the treated material. The volumetric increases were 104, 102, and 98 percent for replicates A B, and C, respectively. Vendor 5's volumetric increases resulted mainly from additions of 0.25 cement and 0.20 sodium silicate.

- 253. <u>Vendor 6.</u> Vendor 6 increased the volume occupied by the untreated material by 70, 79 and 70 percent for treated replicates A, B, and C, respectively.
- 254. <u>Vendor 7.</u> Vendor 7 increased the volume of the clay by 89, 96, and 95 percent for replicates A, B, and C, respectively, approximately doubling the volume required for the clay. The volumetric increase may be largely due to the 0.42 ASR of fly ash added to the clay.
- 255. <u>Vendor 8.</u> The Vendor 8 process increased the volume of the clay for replicates A, B, and C by 87, 85, and 84 percent, respectively. Vendor 8 added a 0.36 ASR of blast furnace slag to the clay, which may have largely contributed to the volumetric increase.

Slump

- 256. The slump was measured for each replicate of the clay immediately after the mixing process was complete. When two consecutive tests showed a falling away characteristic, the mixture lacked cohesiveness and the slump test was not applicable. The results of the slump are presented in Appendix E.
- 257. Vendor 1 slumps for the replicates were 6, 5, and 6.25 in. for A, B, and C, respectively. Slumps of 0 in. were calculated for all replicates of mixtures from Vendors 2, 3, 4, 7, and 8. Vendor 5's replicate A had a slump of 0.5 in., and Vendor 6 slumps were 6 in. for replicate C and 5 in. for replicates A and B.

Moisture results

258. The results of moisture content tests conducted on the treated clay are presented in Appendix E. Moisture tests were performed in triplicate for each replicate of the treated clay after 28 days of cure.

Set time

259. The results of the set time conducted on the treated clay after 2, 4, 8, 24, and 48 hr of cure are presented in Appendix E. CI readings were taken in triplicate for each curing time.

Specific gravity

260. The specific gravities were measured in triplicate for the treated clay after 28 days of cure and are presented in Appendix E.

Bleed water

261. Vendor 1's specimens had a layer of water approximately 2 mm thick on the surface of the one specimen, replicate A. Vendor 5 had a layer of water approximately 1 mm in thickness on the surface of all the specimens.

Specimens prepared by Vendors 3, 7, 2, 4, and 6 did not have a layer of water on their surface.

Cracking

262. Vendor 1's specimens did not have cementitious properties. The replicate C specimens deformed when extruded from the molds. The Vendor 3 and Vendor 4 specimens had small voids in each of the replicates. Vendor 6's specimens had small voids on replicates B and C for the clay. The Vendor 7 specimens had voids in each of the replicates for the clay. The Vendor 8 specimens had cracks approximately 2 to 3 mm in length on all three replicates for the clay.

Results of Contaminant Release Testing

MWEP-1 results for clay

- 263. The results of total chromium and Cr(VI) in the MWEP-1 for treated and untreated clay for each vendor S/S process are presented in Appendix E. Figures 16 and 17 represent the results of MWEP-1 concentrations of total chromium and Cr(VI), respectively.
- 264. Untreated clay. The replicate concentrations for the MWEP-1 leachates were 0.081, 0.071 and 0.049 mg/L for total chromium, and 0.091, 0.069, and 0.057 mg/L for Cr(VI). Replicate A shows a greater concentration of Cr(VI) than total chromium, apparently an anomaly in the results. Most of the total chromium present in the leachates was in the form of Cr(VI).
- 265. <u>Vendor 1.</u> The MWEP-1 concentrations of total chromium were all above the MWEP-1 0.05-mg/L criterion. The mean MWEP-1 concentration was 0.11 mg/L, and the mean Cr(VI) concentration was <0.038 mg/L.
- 266. <u>Vendor 2.</u> The MWEP-1 concentrations were all above the 0.05-mg/L drinking water criterion for chromium. The chromium present was in the form of Cr(VI). The mean Cr(VI) concentration was 0.74 mg/L, and the mean total chromium concentration was 9.757 mg/L.
- 267. <u>Vendor 3.</u> The mean MWEP-1 concentration was 0.12 mg/L total chromium, and the mean Cr(VI) concentration was 0.12 mg/L. The chromium present was in the hexavalent form and caused the replicate concentrations to be above the 0.05 -mg/L criterion.
- 268. Vendor 4. The mean concentration of the replicate total chromium was 0.28 mg/L, and the Cr(VI) was 0.29 mg/L. The concentration of Cr(VI) was

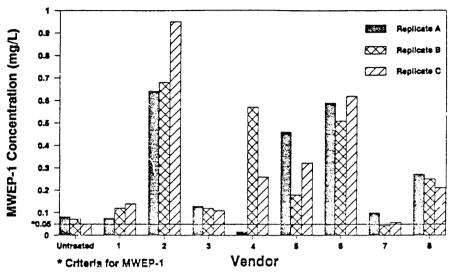


Figure 16. Results of MWEP-1 corcentrations of total chromium in treated and untreated clay

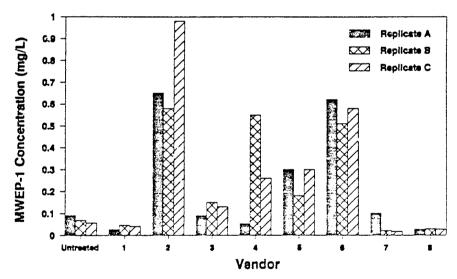


Figure 17. Results of MWEP-1 concentrations of Cr(VI) in treated and untreated clay

greater than the concentration of total chromium. The chromium in Vendor 4's specimens was in the form of Cr(VI).

- 269. Vendor 5. The concentrations of total chromium in the MWEP-1 leachates were 0.46, 0.18, and 0.32 mg/L for all replicates. The concentrations were above the 0.05-mg/L criterion for the MWEP-1. The mean total chromium concentration was 0.32 mg/L, and the mean Cr(VI) concentration was 0.26 mg/L, indicating a majority of the chromium exists as Cr(VI).
- 270. <u>Vendor 6.</u> The total chromium concentrations of the MWEP-1 replicates were 0.59, 0.51, and 0.62 mg/L. The total chromium replicate concentrations were above the 0.05-mg/L criterion. The mean total chromium concentration and the Cr(VI) concentration were 0.57 mg/L, indicating that chromium that was present in the hexavalent form.
- 271. <u>Vendor 7.</u> The concentrations of total chromium in the MWEP-1 replicates were 0.10, 0.042, and 0.056 mg/L. The concentrations of Cr(VI) were 0.10, 0.021, and 0.017 mg/L. The second replicate total chromium concentration was less than the 0.05-mg/L criterion, but the remaining concentrations were greater than the 0.05-mg/L criterion.
- 272. <u>Vendor 8.</u> The mean MWEP-1 concentration of total chromium in the replicates was 0.24 mg/L, and the mean MWEP-1 Cr(VI) concentration was <0.028 mg/L. The chromium existed in the leachates as Cr(III). The replicate leachate concentrations were above the 0.05-mg/L concentration designated for the MWEP-1.

TCLP results for clay

- 273. The results of the TCLP conducted on treated and untreated clay for total chromium and Cr(VI) are presented in Appendix E. Figures 18 and 19 represent the results of the TCLP for total chromium and Cr(VI), respectively.
- 274. <u>Untreated clay.</u> The Cr(VI) TCLP concentrations for untreated clay were all <0.020 mg/L. The total chromium concentrations were 0.22, 0.18, and 0.18 mg/L, with a mean total chromium concentration of 0.19 mg/L. The concentrations were below the 5.0-mg/L criterion for the TCLP.
- 275. <u>Vendor 1.</u> The Vendor 1 process produced total chromium concentrations of 4.4, 4.2, and 4.4 mg/L. Cr(VI) concentrations were all <0.020 mg/L, meaning the chromium present was in the trivalent form.
- 276. <u>Vendor 2.</u> The total chromium concentrations in the TCLP conducted on clay treated by Vendor 2 were 0.094, 0.063, and 0.11 mg/L, with a mean of 0.089 mg/L. The concentrations of Cr(VI) were 0.075, 0.046, and 0.10 mg/L, producing a mean concentration of 0.074 mg/L Cr(VI).

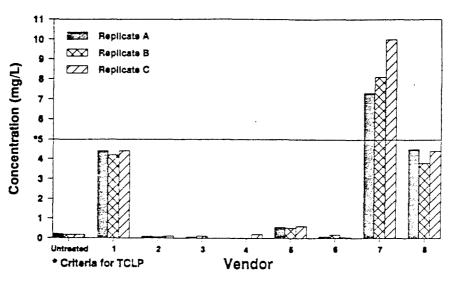


Figure 18. Results of TCLP concentrations of total chromium in treated and uncreated clay

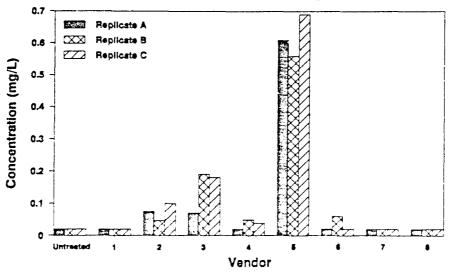


Figure 19. Results of TCLP concentrations of Cr(VI) in treated and untreated clay

- 277. <u>Vendor 3.</u> The total chromium concentrations were 0.062, 0.12, and 0.004 mg/L; the Cr(VI) concentrations were 0.069, 0.19, and 0.18 mg/L. The Cr(VI) concentrations were higher than the total chromium concentrations, apparently representing an anomaly in the results. The mean concentrations for Cr(VI) and total chromium were 0.15 and 0.062 mg/L, respectively.
- 278. Vendor 4. The total chromium concentrations for the clay were 0.012, 0.019, and 0.21 mg/L. The Cr(VI) concentrations were <0.020, 0.049, and 0.038 mg/L for replicates 1, 2, and 3, respectively.
- 279. Vendor 5. The chromium present in the leachates was in the hexavalent form. The TCLP conducted on the treated clay had concentrations of 0.57, 0.53, and 0.62 mg/L for total chromium and 0.61, 0.56, and 0.69 mg/L for Cr(VI). The Cr(VI) concentrations were higher than the total chromium concentrations for all replicates.
- 280. <u>Vendor 6.</u> The chromium present in the TCLP conducted on the treated clay was in the trivalent form. The concentrations of total chromium were 0.072, 0.17, and 0.050 mg/L; the Cr(VI) concentrations were 0.021, 0.061, and <0.020 mg/L. The concentrations of total chromium were all below the 5.0-mg/L criterion for total chromium designated by the TCLP.
- 281. <u>Vendor 7</u> Cr(VI) concentrations in the TCLP conducted on the treated clay were all <0.020 mg/L. The total chromium concentrations were 7.3, 8.1, and 10 mg/L. The concentrations of total chromium in the TCLP leachate are above the 5.0-mg/L criterion for total chromium in the TCLP.
- 282. <u>Vendor 8.</u> The Cr(VI) concentrations in the TCLP were all <0.020 mg/L, and the total chromium concentrations were 4.5, 3.8, and 4.4 mg/L. The concentrations were below the 5.0-mg/L criterion for total chromium in the TCLP.

Effects of Dilution on Leaching

MWEP-1 results for clay

- 283. Untreated clay. The mean NMLCs of total chromium and Cr(VI) were 0.977 and 1.053 mg/kg, respectively. Based on the NMLC for total chromium and Cr(VI), the efficiency of the vendor processes was evaluated.
- 284. <u>Vendor 1.</u> Normalization of the total chromium concentrations presented a MNMTCL of 1.938 mg/kg. The mean NMLC of the MNMTCL increased by 98 percent, and the MNMCSL was decreased by 38 percent. Vendor 1 decreased mobilization of Cr(VI) but increased mobilization of Cr(VII).

- 285. Vendor 2. The mean NMLC of total chromium was 11.74 mg/kg, resulting in an increase in the MNMTCL of 1,102 percent. The mean NMLC for Cr(VI) was 11.41 mg/kg, representing an increase in the MNMCSL of 984 percent.
- 286. Vendor 3. The mean NMLC for total chromium was 2.249 mg/kg, and the mean NMLC for Cr(VI) was 2.291 mg/kg. The Vendor 3 process caused an increase in the MNMTCL of 130 percent and an increase in the MNMCSL of 118 percent.
- 287. Vendor 4. Based on the mean total chromium NMLC (5.883 mg/kg), and the mean Cr(VI) NMLC (6.001 mg/kg), there was an increase in the MNMTCL of 502 percent and an increase in the MNMCSL of 470 percent. The presence of Cr(VI) caused the increase in the MNMTCL.
- 288. <u>Vendor 5.</u> Based on the MNMTCL of 7.207 mg/kg, the increase in MNMTCL was 638 percent. The MNMCSL was 5.842 mg/kg, causing an increase in MNMCSL from the untreated clay of 455 percent.
- 289. <u>Vendor 6.</u> Compared to the mean normalized concentration of the untreated MWEP-1 leachate, there was an increase of total chromium in the treated leachate of 1,115 percent and an increase in Cr(VI) of 1,020 percent.
- 290. <u>Vendor 7.</u> The second replicate represented an increase in the MNMTCL of 60 percent when compared to the untreated MWEP-1 concentration for that replicate. There was an increase in the MNMTCL of 40 percent and a decrease in the MNMCSL of 9 percent.
- 291. <u>Vendor 8.</u> The Vendor 8 treatment process caused an increase in the MNMTCL of 366 percent and a decrease in the MNMCSL of 50 percent. Vendor 8 successfully reduced Cr(VI), but Cr(III) remained mobile.

TCLP results

- 292. Normalization of the TCLP results was calculated according to the methods described for normalization of the MWEP-1 (paragraph 206). These results are presented in Appendix E.
- 293. <u>Untreated clay.</u> The NMLCs were 5.603 mg/kg total chromium and 0.578 mg/kg Cr(VI) in the TCLP. Based on the NMLCs for the untreated clay, the efficiency of each vendor process was calculated as a percentage of the untreated NMLC.
- 294. Vendor 1. The mean NMLC of total chromium was 146.8 mg/kg chromium, producing a 2,520-percent increase in the MNMTCL in the TCLP for clay. The concentrations of Cr(VI) were all <0.020 mg/L. The mean NMLC for Cr(VI) was 0.678 mg/kg based on the detection limit, producing a 17-percent increase in the MNMCSL.

- 295. <u>Vendor 2.</u> Normalization of the total chromium produced masses of 2.863, 2.013, and 3.384 mg/kg, respectively, for the replicates. Vendor 2 reduced the MNMTCL in the treated TCLP by 51 percent and increased the MNMCSL by 294 percent.
- 296. <u>Vendor 3.</u> Based on total chromium concentrations, Vendor 3 reduced the MNMTCL by 59 percent and increased the MNMCSL by 843 percent. The MNMTCL was 2.303 mg/kg, and the MNMCSL was 5.455 mg/kg.
- 297. <u>Vendor 4.</u> The mean normalized total chromium leached was 2.586 mg/kg, producing a 54-percent reduction in the MNMTCL compared to the total chromium leached in the TCLP conducted on the untreated clay. The mean NMLC for Cr(VI) was 1.348 mg/kg, resulting in a 133-percent increase in the MNMCSL.
- 298. <u>Vendor 5.</u> The mean NMLCs for total chromium and Cr(VI) were 25.666 and 27.764 mg/kg, respectively. The Vendor 5 process increased the NMTCL for the treated clay compared to NMTCL for untreated clay by 358 percent. The MNMCSL was increased by 4,701 percent.
- 299. <u>Vendor 6.</u> The mean NMLC of total chromium was 3.999 mg/kg, decreasing the MNMTCL by 29 percent. The mean NMLC for Cr(VI) was 1.397 mg/kg, resulting in a 142-percent increase in the MNMCSL.
- 300. Vendor 7. The NMLC was 347.174 mg/kg total chromium, representing a 6,097-percent increase in total chromium leached in the TCLP. All Cr(VI) concentrations were <0.020 mg/L. The mean NMLC for Cr(VI) was 0.823 based on the detection limit, an increase in the MNMCSL of 42 percent.
- 301. <u>Vendor 8.</u> The MNMTCL was 158.328 mg/kg, representing a 2,726-percent increase in the MNMTCL in the TCLP. All Cr(VI) concentrations were <0.020 mg/L. Based on the detection limit, the mean NMLC for Cr(VI) was 0.749 mg/kg, an increase in the MNMCSL of 30 percent.

Standard Deviation and Relative Standard Deviation

MWEP - total chromium

- 302. <u>Untreated.</u> The NMLCs for replicates A, B, and C were 1.21, 1.06, and 0.66~mg/kg, respectively. The NMLC standard deviation for the clay was 0.283 with a NMLC RSD of 29 percent.
- 303. <u>Vendor 1.</u> Vendor 1 varied the amount of additive used among their replicates; therefore, precision of the results must be based on the NMLC. The NMLCs for replicates A, B, and C were 1.09, 2.18, and 2.54 mg/kg.

respectively. The standard deviation of the NMLC for clay was 0.76. The MWEP-1 concentrations for the treated clay had an average precision of 39 percent for the clay, based on NMLC calculations.

- 304. <u>Vendor 2.</u> The NMLCs for replicates A, B, and C were 9.75, 10.86, and 14.61 mg/kg, respectively. Precision of the NMLC for the clay was 22 percent. The standard deviation of the NMLC calculated for the clay was 2.55.
- 305. <u>Vendor 3.</u> The NMLCs for replicates A, B, and C were 2.48, 2.20, and 2.07 mg/kg, respectively. The NMLC standard deviation for the clay was 0.21. Based on the NMLC, the precision of the clay was 9 percent.
- 306. <u>Vendor 4.</u> The NMLCs for replicates A, B, and C were 0.34, 11.76, and 5.55 mg/kg, respectively. The NMLC standard deviation for the clay was 5.88, and the NMLC RSD was 97 percent. Two replicate concentrations were 0.57 and 0.26 mg/L. The other replicate concentration for the MWEP-1 was 0.02 mg/L, causing a large NMLC RSD.
- 307. Vendor 5. The NMLCs were 10.47, 3.90, and 7.25 mg/kg for replicates A, B, and C, respectively. The clay NMLC standard deviation was 3.29 with an NMLC RSD of 46 percent.
- 308. <u>Vendor 6.</u> The NMLCs were 12.20, 10.37, and 13.04 mg/kg for replicates A, B, and C, respectively. Based on NMLC concentrations, the standard deviation was 1.36 and the NMLC RSD 11 percent.
- 310. Vendor d. The NMLCs were 4.93, 4.80, and 3.93 mg/kg for replicates A, B, and C, respectively. The NMLC standard deviation for the clay was 0.54 and the NMLC RSD was 12 percent.

MWEP - chromium (VI)

- 311. <u>Untreated.</u> The NMLCs for replicates A, B, and C were 1.36, 1.03, and 0.77~mg/kg, respectively. The NMLC standard deviation for the clay was 0.295 with an NMLC RSD of 28 percent.
- 312. Vendor 1. The NMLCs for replicates A, B, and C were <0.39, <0.83, and <0.74 mg/kg, respectively. The NMLC standard deviation was 0.233, and the NMLC RSD was 35 percent.
- 313. Vendor 2. The NMLCs for replicates A, B, and C were 9.90, 9.27, and 15.08 mg/kg, respectively. The NMLC standard deviation for the clay was 3.19, with an NMLC RSD of 28 percent.

- 314. <u>Vendor 3.</u> The NMLCs for replicates A, B, and C were 1.68, 2.75, and 2.45 mg/kg, respectively. The NMLC standard deviation for the clay was 0.55, and the NMLC RS was 24 percent.
- 315. <u>Vendor 4.</u> The NMLCs for replicates A, B, and C were 1.11, 11.35, and 5.55 mg/kg, respectively. The NMLC RSD was 86 percent. The high NMLC RSD for the clay was the result of one concentration that was one order of magnitude less than the remaining two. In calculating the NMLC RSD, the detection limit was used with the other two replicate concentrations.
- 316. <u>Vendor 5.</u> The NMLCs were 6.83, 3.90, and 6.80 mg/kg for replicates A, B, and C, respectively. The NMLC standard deviation was 1.68 with an NMLC RSD of 29 percent.
- 317. <u>Vendor 6.</u> The concentrations of the clay replicates were 0.62, 0.51, and 0.58 mg/L, all within a 0.11-mg/L difference. The NMLCs were 12.82, 10.37, and 12.20 mg/kg for replicates A, B, and C, respectively. For the clay, the NMLC standard deviation was 1.27 and the NMLC RSD was 11 percent.
- 318. <u>Vendor 7.</u> The NMLCs were 2.11, 0.43, and 0.34 mg/kg, for replicates A, B, and C, respectively. One concentration among the replicates was one order of magnitude greater than the other concentrations, causing a relatively high NMLC RSD. The NMLC standard deviation was 1.00 with an NMLC RSD of 104 percent.
- 319. <u>Vendor 8.</u> For the clay, the concentrations were <0.027, <0.029, and <0.028 mg/L. Based on the detection limit concentrations, the NMLC concentrations were calculated. The NMLCs were 0.49, 0.56, and 0.52 mg/kg for replicates A, B, and C, respectively. The NMLC standard deviation was 0.032, and the NMLC RSD was 6 percent.

TCLP - total chromium

- 320. <u>Untreated</u>. The replicate concentrations were within 0.03 mg/L among replicates. The NMLCs for replicates A, B, and C were 6.57, 5.37, and 4.86 mg/kg, respectively. The NMLC standard deviation was 0.875, and the NMLC RSD was 16 percent.
- 321. <u>Vendor 1.</u> The NMLCs for replicates A, B, and C were 128.15, 152.30, and 160.00 mg/kg, respectively. The NMLC standard deviation was 16.61. The NMLC RSD clay was 11 percent.
- 322. <u>Vendor 2.</u> The NMLCs for replicates A, B, and C were 2.86, 2.01, and 3.38 mg/kg, respectively, providing a NMLC RSD for the clay of 25 percent.
- 323. Vendor 3. The NMLCs were 2.37, 4.39, and 0.151 mg/kg for replicates A, B, and C, respectively. The lowest NMLC was based on a TCLP

concentration of 0.004 mg/L and was two orders of magnitude less than one of the replicates. The NMLC RSD was 92 percent.

- 324. <u>Vendor 4.</u> The concentrations of chromium in the clay were 0.012, 0.019, and 0.21, which normalized to 0.511, 0.784, and 6.46 mg/kg, respectively. Based on the NMLC concentrations, the NMLC RSD was 130 percent.
- 325. <u>Vendor 5.</u> TCLP concentrations of 0.57, 0.53, and 0.62 mg/L normalized to 25.95, 22.95, and 28.10 mg/kg, respectively. The NMLC standard deviation was 2.59 with a NMLC RSD of 10 percent.
- 326. <u>Vendor 6.</u> The TCLP concentrations were 0.07, 0.17, and 0.05 mg/L, which correspond to NMLCs of 2.98, 6.91, and 2.10 mg/kg, respectively. The NMLC standard deviation was 2.56, and the NMLC RSD was 64 percent.
- 327. Vendor 7. The total chromium concentrations in the clay replicates were 7.3, 8.1, and 10.0 mg/L. The NMLCs were 309.26, 331.91, and 400.35 mg/kg, respectively. The NMLC standard deviation was 47.4, and the NMLC RSD was 14 percent.
- 328. <u>Vendor 8.</u> The concentrations of total chromium in the clay were 4.5, 3.8, and 4.4 mg/L and were normalized to 164.3, 146.0, and 164.7 mg/kg, respectively. Based on the NMLC, the standard deviation was 10.7 and the NMLC RSD was 7 percent.

TCLP - chromium (VI)

- 329. <u>Untreated</u>. The concentrations of Cr(VI) in the clay were <0.020 mg/L for all replicates. Based on the detection limit of 0.020 mg/L, the NMLCs were calculated as 0.60, 0.60, and 0.54 mg/kg for the clay. The NMLC standard deviation for the clay was 0.033, and the NMLC RSD was 6 percent.
- 330. Vendor 1. The concentrations of Cr(VI) for the clay were all <0.020 mg/L. The clay NMLCs were 0.58, 0.73, and 0.73 mg/kg with a standard deviation of 0.083 and NMLC RSD of 12 percent.
- 331. Vendor 2. The NMLCs for clay were 2.28, 1.47, and 3.08 mg/kg with a standard deviation of 0.803 and NMLC RSD of 35 percent.
- 332. <u>Vendor 3.</u> Based on the concentrations of Cr(VI) in the untreated clay, Vendor 3 mobilized Cr(VI). The concentrations of Cr(VI) were 0.07, 0.19, and 0.18 mg/L and were normalized to 2.63, 6.96, and 6.78 mg/kg, respectively. The NMLC RSD was 45 percent.
- 333. Vendor 4. The NMLCs for the clay were 0.85, 2.02, and 1.17 mg/kg with a standard deviation of 0.605 and NMLC RSD of 45 percent.

- 334. <u>Vendor 5.</u> The concentrations in the TCLP extracts were 0.61, 0.56, and 0.69 mg/L. The NMLCs were 27.77, 24.25, and 31.28 mg/kg of Cr(VI) leached with a standard deviation of 3.515 and NMLC RSD of 13 percent.
- 335. Vendor 6. The NMLC standard deviation and NMLC RSD for the clay were 0.939 and 67 percent, respectively, based on NMLCs of 0.87, 2.48, and 0.84 mg/kg.
- 336. Vendor 7. The concentrations of Cr(VI) in the clay leachates were all <0.020 mg/L. Normalization based on 0.020 mg/L for the clay resulted in NMLCs of 0.85, 0.82, and 0.80 mg/kg. The NMLC standard deviation was 0.023, and the NMLC RSD was 3 percent.
- 337. <u>Vendor 8.</u> The Vendor 8 concentrations in the TCLP extracts for the clay were all <0.020 mg/L. NMLCs, which were calculated based on a concentration of 0.020 mg/L, were 0.73, 0.77, and 0.75 mg/kg. The NMLC standard deviation and NMLC RSD for the clay were 0.019 and 3 percent, respectively.

Analysis of variance for MWEP-1 and TCLP

- 338. MWEP-1. The results of the ANOVA conducted on the clay for the MWEP-1 are presented in Table 19. An ANOVA conducted on the MWEP-1 data showed four groups of data. Vendors 6 and 2 are not significantly different, and Vendors 4 and 5 are not significantly different. Vendors 4, 8, 3, 1, and 7 are intertwined in groups that are not significantly different.
- 339. TCLP. The results of an ANOVA conducted on the clay on the TCLP are also presented in Table 19. For the clay, the TCLP data contains three groups. Vendor 7 is significantly different from the remaining vendors. Vendors 8 and 1 are not significantly different and are the second group. Group 3 contains the remaining vendors, which are not significantly different.

Table 19

Results of ANOVA for TCLP and MWEP-1 for Total Chromium in the Clay

	Mean NMLC	
<u>Vendor</u>	<u>mg/kg</u>	Group
	MWEP-1	
6	11.871	1
2	11.742	1
5	7.207	2
4	5.883	2,3
8	4.554	2,3,4
3 1	2.249	3,4
1	1.938	3,4
7	1.367	3,4
*	0.977	4
	TCLP	
7	347.17	1
8	158.33	2
1 5	146.81	2
	25.67	3
*	5.60	3
6	4.00	3
2	2.75	3
4	2.59	3
3	2.30	3

^{*} Untreated clay.

PART V: CONCLUSIONS AND RECOMMENDATIONS

Conclusions

340. A bench-scale study conducted on FHC fill and clay was conducted to evaluate the effectiveness of S/S technologies on immobilization of chromum and Cr(VI). The physical tests conducted on the untreated fill and clay were moisture content, UCS, bulk density, permeability, grain size analysis, Proctor density, specific gravity, Atterberg limits, and resistance to penetration. The physical tests conducted on the treated fill and clay were moisture content, UCS, bulk density, permeability, specific gravity, set time, bleed water, slump, cracking, and wet/dry durability. Chemical characterization consisted of MWEP-1, TCLP, and bulk chemistry analyses for the treated and chemical tests for the fill and clay, respectively, on a pass/Lail basis. Conclusions based on these results are summarized below.

Table 20

Results of Physical and Chemical Tests Conducted on

Frontier Hard Chrome Fill

		с	riterion		
<u>Vendor</u>	UCS - >50 psi	Permeability - 1E-08 cm/sec or 2 Orders of Magn. < Untreated	Wet/Dry - 30% Solids Loss	MWEP-1 - 0.05 mg/L	TCLP - 5.0 mg/L
*	Fail	Fail**	NA	Fail	Pass
1	Fail	Fail	Fail	Fail	Pass
2	Pass	Fail	Pass	Fail	Pass
3	Pass	Fail	Pass	Fail	Pass
4	Pass	Fail	Pass	Fail	Pass
5	Pass	Fail	Pass	Fail	Pass
6	Pass	Fail	Pass	Fail	Pass
7	Pass	Fail	Pass	Fail	Pass
8	Pass	Fail	Pass	Fail	Pass

^{*} Untreated fill.

^{**} The permeability results for the untreated fill were not <1E-08 cm/sec.

Table 21

Results of Physical and Chemical Tests Conducted on

Frontier Hard Chrome Clay

		C	riterion		
<u>Vendor</u>	UCS - >50 psi	Permeability - 1E-08 cm/sec or 2 Orders of Magn. < Untreated	Wet/Dry - 30% Solids Loss	MWEP-1 - 0.05 mg/L	TCLP - 5.0 mg/L
*	Fail	Fail**	NA	Fail	Pass
1	Fail	Fail	Fail	Fail	Pass
2	Pass	Fail	Pass	Fail	Pass
3	Fail	Fail	Pass	Fail	Pass
4	Fail	Fail	Pass	Fail	Pass
5	Pass	Fail	Pass	Fail	Pass
6	Pass	Fail	Pass	Fail	Pass
7	Pass	Fail	Pass	Fail	Fail
8	Pass	Fail	Pass	Fail	Pass

^{*} Untreated clay.

- a. Binders can be added to the fill and clay to produce UCS values above the 50-psi criteria. The following vendors were successful in meeting the 50-psi criteria for the fill and clay: Vendor 2, Vendor 5, Vendor 6, Vendor 7, and Vendor 8.
- b. None of the vendors was successful in reducing the permeability of the fill and clay to 1E-08 cm/sec or two orders of magnitude less than the permeability of the untreated fill and clay.
- $\underline{\mathbf{c}}$. The S/S processes applied in this investigation can produce specimens that pass 12 cycles of the wet/dry test. Vendor 1 specimens failed to pass the wet/dry test, but the remaining vendors were successful.
- d. Although a large portion of the fill contains debris, the fill and clay can be mixed with the binders.
- e. The treated fill and clay can pass the 5.0-mg/L TCLP criterion for chromium. Excluding Vendor 7, the remaining vendors passed the TCLP.
- \underline{f} . The S/S processes applied in this investigation did not pass the 0.05-mg/L criterion for chromium in the MWEP-1.
- g. Cr(VI) can be reduced by reagents added to the S/S process. Cr(VI) concentrations in the untreated fill and clay were

^{**} The permeability results for the untreated fill were not <1E-08 cm/sec.

<0.020, indicating that reactions with the acetic acid leachate fluid may reduce Cr(VI) without treatment. In the MWEP-1, three vendors were successful in reducing Cr(VI) in the fill and clay: Vendor 1, Vendor 7, and Vendor 8. Although Cr(VI) was reduced, the total chromium concentration did not meet the criterion for the MWEP-1.

Recommendations

341. Recommendations based on results of this study are summarized below.

- a. The criteria designated for the permeability were not met. Discussions during the design phase of the bench-scale investigation revealed that the criteria may not be within reach. Reevaluation of the criteria may be necessary.
- b. Although some of the S/S processes reduced the leachability of chromium in the MWEP-1, the 0.05-mg/L criterion was not achieved. Determinations as to whether this criterion is applicable must be made before preceding with application of the S/S technologies demonstrated in this investigation.
- Sased on the bench-scale evaluation, application of some of the S/S technologies investigated in this study improves the physical handling properties of the soils and reduces Cr(VI), indicating success might be attainable in a field investigation. However, the chromium concentrations in TCLP and MWEP-1 leachates were greater after treatment than they were before treatment, indicating that S/S technologies should not be applied to improve chemical properties of the soils.

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APPENDIX A: INITIAL SCREENING TEST RESULTS, WES

Table Al

Matrix of Specimens Prepared for Initial Soil/Binder

Screening for the Frontier Hard Chrome Fill

Binder/Soil Ratio	Water/Soil Ratio	Number of Specimens
Cement/soil		
0.1	0.1	1
0.4	0.1	1
0.7	0.1	1
1.4	0.1	1
0.1	0.3	1
0.4	0.3	
0.7	0.3	1 1 1
1.4	0.3	1
		Total: 8
ime/fly ash/soil		
0.1/0.1	0.1	1
0.1/0.4	0.1	1
0.1/0.7	0.1	1
0.4/0.1	0.1	1
0.4/0.4	0.1	1
0.4/0.7	0.1	1
0.7/0.1	0.1	1
0.1/9.1	0.3	1
0.1/0.4	0.3	1
0.1/0.7	0.3	1
0.4/0.1	0.3	1
0.4/0.4	0.3	1
0.4/0.7	0.3	ī
0.7/0.1	0.3	1
0.7/0.4	0.3	ī
0.7/0.7	0.3	ī
		Total: 16

Total: 16

Table A2

Results of the Initial Screening Tests Conducted by

WES on Frontier Hard Chrome Fill

Binder/Soil Ratio	Water/Soil Ratio	*	<u>Cone Inde</u>	x Value,	psi	
Cement/soil		(Cure Time		Time, hr)	e, hr)	
		1.	4	8	24	
0.1	0.1	O	60	247	750+	
0.4	0.1	37	177	750+	750+	
0.7	0.1	137	703	750+	750+	
1.4	0.1	750+	750+	750+	750+	
0.1	0.3	0	0	293	100	
0.4	0.3	0	0	30	750+	
0.7	0.3	0	20	643	750+	
1.4	0.3	17	490	750+	750+	
Lime/fly ash/soil						
0.1/0.1	0,1	35	25	40	63	
0.1/0.4	0.1	10	27	23	33	
0.1/0.7	0.1	87	158	150	217	
0.4/0.1	0.1	387	357	583	703	
0.4/0.4	0.1	183	340	193	83	
0.4/0.7	0.1	192	607	700	307	
0.7/0.1	0.1	527	517	505	500	
0.1/0.1	0.3	0	0	0	0	
0.1/0.4	0.3	0	0	0	3	
0.1/0.7	0.3	ა	0	0	7	
0.4/0.1	0.3	20	20	30	30	
0.4/0.4	0.3	73	133	103	207	
0.4/0.7	0.3	147	247	223	280	
0.7/0.1	0.3	207	250	190	297	
0.7/0.4	0.3	180	180	133	217	
0.7/0.7	0.3	153	173	160	203	

^{*} Represents an average of three replicates.

Table A3

Matrix of Specimens Prepared for Initial Clay/Binder

Screening for the Frontier Hard Chrome Clay

Binder/Clay Ratio	Water/Clay Ratio	Number of Specimens
Cement/clay		
0.1	0.1	1
0.4	0.1	1
0.7	0.1	1
1.4	0.1	1
0.1	0.2	1
0.4	0.2	1
0.7	0.3	1
1.4	0.3	1
		Total: 8
Lime/fly ash/clay		
0.1/0.1	0.1	1
0.1/0.4	0.1	1
0.1/0.7	0.1	1
0.4/0.1	0.1	1
0.4/0.4	0.1	1
0.4/0.7	0.1	1
0.1/0.1	0.3	1
0.1/0.4	0.3	1
0.1/0.7	0.3	1
0.4/0.1	0.3	1
0.4/0.4	0.3	1
0.4/0.7	0.3	1
0.7/0.1	0.3	1
0.7/0.4	0.3	1
0.7/0.7	0.3	1
		Total: 15

А5

Table A4

Results of the Initial Screening Tests Conducted by

WES on Frontier Hard Chrome Clay

Binder/Clay Ratio	Water/Clay Ratio	*	Cone Inde	x Value.	psi
Cement/clay			(Cure	Time, hr)	
		1	4_	8	24_
0.1	0.1	25	147	347	487
0.4	0.1	160	348	750+	750+
0.7	0.1	245	190	750+	750+
1.4	0.1	750+	750+	750+	750+
0.1	0.2	0	55	127	217
0.4	0.2	18	262	387	750+
0.7	0.3	43	150	447	750+
1.4	0.3	127	408	750+	750+
Lime/fly ash/clay					
0.1/0.1	0.1	60	67	183	63
0.1/0.4	0.1	130	173	190	193
0.1/0.7	0.1	35	63	53	65
0.4/0.1	0.1	117	160	143	203
0.4/0.4	0.1	75	103	133	180
0.4/0.7	0.1	102	133	167	195
0.1/0.1	0.3	O	0	0	13
0.1/0.4	0.3	0	7	3	10
0.1/0.7	0.3	3	7	20	37
0.4/0.1	0.3	43	50	30	100
0.4/0.4	0.3	180	193	190	263
0.4/0.7	0.3	140	153	187	197
0.7/0.1	0.3	167	163	193	217
0.7/0.4	0.3	217	163	357	267
0.7/0.7	0.3	157	150	223	150

 $[\]star$ Represents an average of three replicates.

APPENDIX B: RESULTS OF PHYSICAL TESTS CONDUCTED ON UNTREATED FILL

Table B1 Results of Moisture Content Conducted on Fill

Sample		Moisture*
ID		(%)
	Replicate A	
UC-SA-B1		29.75
UC-SA-B2		24.22
UC-SA-B3		25.05
UC-SA-B4		29.36
UC-SA-B5		28.71
UC-SA-B6		28.87
UC-SA-B7		28.34
UC-SA-B8		27.23
UC-SA-B9		29.96**
UC-SA-B10		27.25
UC-SA-B11		28.18
	Average	27.9
1	Replicate B	
UC-SB-B1		23.07
UC-SB-B2		23.88
UC-SB-B3		22.77
UC-SB-B4		24.21
UC-SB-B5		20.92
UC-SB-B6		20.04
UC-SB-B7		17.11**
UC-SB-B8		24.31
UC-SB-B9		17.33
JC-SB-B10		22.90
JC-SB-B11		22.47
	Average	21.7
<u> </u>	Replicate C	
JC-SB-Bl		23.75
JC-SB-B2		26.94
JC-SB-B3		24.95
JC-SC-B4		24.93
JC-SC-B5		24.07
JC-SC-B6		24.37
JC-SC-B7		23.68
IC-SC-B8		22.71**
C-SC-B9		25.64
C-SC-B10		24.51
C-SC-B11		28.28
	Average	24.8

^{*} Moisture based on wet weight/dry solids.** These buckets were used by WES for initial screening tests and Cr(VI) reduction studies.

Table B2 Results of Moisture Contents Conducted on Sieved Fill*

Sample	Moisture**
ID	(8)
UC-SA-Bl	40.36
UC-SA-B2	42.16
UC-SA-B3	42.31
UC-SA-B4	41.31
UC-SA-B5	33.89
UC-SA-B6	43.50
UC-SA-B7	41.76
UC-SA-B8	39.59
UC-SA-B9	40.29
UC-SA-B10	40.64
UC-SA-B11	38.98
UC-SB-B1	32.84
UC-SB-B2	35.80
JC-SB-B3	37.76
JC-SB-B4	37.50
UC-SB-B5	35.94
JC-SB-B6	38.26
JC-SB-B7	30.84
JC-SB-B8	33.04
JC-SB-B9	35.94
JC-SB-B10	35.85
JC-SB-B11	37.61
JC-SC-B1	37.50
JC-SC-B2	34.53
JC-SC-B3	39.11
JC-SC-B4	37,37
JC-SC-35	35.94
JC-SC-B6	39.08
JC-SC-B7	38.12
IC-SC-B8	38.71
JC-SC-B9	38.31
JC-SC-B10	38.62
JC-SC-Bll	39.12

^{*} Sieved through a No. 10 (2.0-mm) sieve.** Moisture based on wet weight/dry solids.

Table B3

Particle Size Analysis for Frontier Hard Chrome Fill

Weight	Sieve Size (in.) or Number	Opening mm	Percent Finer	Cumulative Percent
		Fill Replicate 1		
0.00	1.5	37.50	100.00	0.00
93.90	1	25.00	98.50	1.50
708.70	3/4	19.10	86.90	13.10
927.70	1/2	12.50	71.80	28.20
654.30	3/8	9.50	61.20	38.80
405.80	No. 3	6.35	54.60	45.40
216.90	No. 4	4.75	51.10	48.90
6.00	No. 6	3.35	46.40	53.60
15.60	No. 10	2.00	39.00	61.00
20.80	No. 16	1.18	35.00	65.00
23.80	No. 20	0.85	32.70	67.30
26.70	No. 30	0.60	30.40	69.60
29.90	No. 40	0.43	28.00	72.00
33.60	No. 50	0.30	25.10	74.90
36.30	No. 70	0.21	22.80	77.20
39.00	No. 100	0.15	20.90	79.10
40.60	No. 140	0.11	19.70	80.30
41.80	No. 200	0.08	18.80	81.20

Liquid limit = 37

Plasticity limit - 32
Plasticity index - 5

Specific gravity - 2.70

(Continued)

(Sheet 1 of 3)

[%] Gravel - 43.9
% Sand - 32.3
% Fines - 18.8

Table B3 (Continued)

Weight	Sieve Size (in.)	Opening	Percent	Cumulative
	or Number	<u>mm</u>	Finer	Percent
		Fill Replicate 2		
0.00	1.5	37.50	100.00	0.00
101.30	1	25.00	98.20	1.80
317.30	3/4	19.10	92.70	7.30
733.90	1/2	12.50	79.90	20.10
536.00	3/8	9.50	70.50	29.50
518.30	No. 3	6.35	61.50	38.50
315.30	No. 4	4.75	56.00	44.00
5.80	No. 6	3.35	52.20	47.80
18.70	No. 10	2.00	43.80	56.20
27.00	No. 16	1.18	38.30	61.70
31.90	No. 20	0.85	35.10	64.90
36,40	No. 30	0.60	32.20	67.80
41.50	No. 40	0.43	28.90	71.10
48.20	No. 50	0.30	24.50	75.50
53.20	No. 70	0.21	21.20	78.80
57.10	No. 100	0.15	18.60	81.40
59.90	No. 140	0.11	16.80	83.20
62.00	No. 200	0.08	15.40	84.60

% Gravel	-	44.0	Liquid limit	-	44
% Sand	-	40.6	Plasticity limit	-	40
% Fines	-	15.4	Plasticity index	-	4
			Specific gravity	-	2.69

(Continued)

(Sheet 2 of 3)

Table B3 (Concluded)

Weight	Sieve Size (in.) or Number	Opening mm	Percent <u>Finer</u>	Cumulative Percent
		Fill Replicate 3		
0.00	2	50.00	100.00	0.00
50.90	1.5	37.50	99.20	0.80
122.90	1	25.00	97.30	2.70
328.20	3/4	19.10	92.20	7.80
860.60	1/2	12.50	78.90	21.10
648.40	3/8	9.50	68.90	31.10
588.00	No. 3	o.35	59.80	40.20
447.70	No. 4	4.75	52.90	47.10
7.70	No. 6	3.35	48.30	51.70
19.00	No. 10	2.00	41.60	58.40
27.80	No. 16	1.18	36.30	63.70
32.90	No. 20	0.85	33.30	66.70
37.50	No. 30	0.60	30.63	69.40
42.60	No. 40	0.43	27.50	72.50
49.00	No. 50	0.30	23.70	76.30
54.10	No. 70	0.21	20.70	79.30
57.90	No. 100	0.15	18.40	81.60
60.80	No. 140	0.11	16.70	83.30
63.00	No. 200	0.08	15.40	84.60

[%] Gravel - 47.1
% Sand - 37.5
% Fines - 15.4

Liquid limit - 43

Plasticity limit - 43
Plasticity index - 10
Specific gravity - 2. 2.69

⁽Sheet 3 of 3)

APPENDIX C: RESULTS OF PHYSICAL AND CHEMICAL TESTS ON TREATED FILL

Tuble C1

Results of the Wet/Dry Test Conducted on

Frontier Hard Chrome Fill

Vendor	Sample	Replicate	Total 1 Lost
1	Test	1 2 3	NA 100.00 100.00
	Control	1 2 3	NA 100.00 100.00
2	Test	1 ·2 3	0.32 0.31 0.32
	Control	1 2 3	0.40 0.47 0.40
3	Test	1 2 3	0.21 20.26 0.21
	Control	1 2 3	0.30 0.38 0.21
4	∵est	1 2 3	0.36 0.30 0.51
	Control	1 2 3	0.42 0.42 0.58
5	T _f st	1 2 3	0.43 0.31 0.34
	Control	1 2 3	0.33 0.49 0.58
6	Test	1 2 3	0.46 0.66 0.34
	Control	1 2 3	0.34 0.51 0.73 0.35

(Continued)

Table C1 (Concluded)

			Total
Vendor	Sample	Replicate	<pre>§ Lost</pre>
	Test	1	0.42
7	1632	2	1.29
		3	0.78
	Control	1	1.01
	Concret	2	1.19
		3	1.01
•	Test	1	0.18
8	lest	2	0.09
		3	0.23
	C1	ĩ	0.13
	Control	2	0.04
		3	0.22

Table C2

Results of Moisture Content, Specific Gravity, and Slump

Tests Conducted on Frontier Hard Chrome Fill

			Moisture	Specific	Slump
<u>Vendor</u>	Rep]	icate	<u> </u>	Gravity	<u>in.</u>
1	A	1	44.29	2.71	7
		2	48,59		
		2 3	45.87		
	В	1	36.74	2.72	0
		1 2 3 1 2	35.31		
		3	37.15		
	С	1	36.98	2.76	1.25
		2	39.13		
		3	39.41		
2	A	1	13.55	2.8	0
		2	12.61		
		3 1 2 3	10.92		
	В	1	13.61	2.82	0
		2	13.70		
		3	12.80		
	C	1	15.23	2.82	e
		2	15.72		
		2 3 3 1 2	15.95		
_		3	39.41		
3	A	1	18.07	2.64	0
		2	18.68		
		3	19.20		
	В	3 1 2 3	17.55	2.65	0
		2	17.07		
	_	3	15.75		
	С	1	11.48	2.66	0
		2 3	14.81		
		3	13.95		
4	A	1	36.68	2.78	0
		2	36.59		
		3	36.09		
	В	1	34.64	2.89	0
		2	35.80		
	_	3	35.74		
	С	1	34.42	2.92	0
		2 3	35.25		•
		3	35.16		

Table C2 (Concluded)

Vendor	R1	cate	Moisture	Specific Gravity	Slump in.
	Α		25.61	2.78	8
5	Α.	2	25.22	•	
		3	25.48		
	В	í	26.80	2.78	6.5
	b	2	25.88		
		3	26.97		
	С	ī	31.86	2.79	7.25
	· ·	2	30.04		
		1 2 3 1 2 3 1 2 3	32.75		
6	Α	1	47.66	2.78	NA
•		1 2 3	47.26		
		3	47.12		
	В	1	52.97	2.81	NA
		2 3	52.83		
		3	53.45		
	C	1	47.25	2.82	NA
		2	47.97		
		3	47.65	•	
7	Α	1	25.04	2.72	0
		2	25.18		
		3	24.98		•
	В	2 3 1 2	26.52	2.71	0
		2	26.46		
		3	26.38	A 70	0
	С	1	25.25	2.72	U
		2 3	25.52		
		3	25.37		
8	A	1	21.39	2.77	1.1.
Ū	• •	2	21.73		
		3	22.55		
	В	1	17.03		0.25
		2	17.57		
		3	17.31		
	С	1	18.47	2.79	0
		2	23.48		
		3	18.50		

Table C3

Results of Set Time Tests Conducted on

Frontier Hard Chrome Fill

		Ave	erage Cone Ind	ex, psi	
C			(Time, hr)		
Sample ID	_2_		۰	24	4.0
		4	8_	_24	48
V1-SA	0	0	0	0	0
V1-SB	27	48	85	117	47
V1-SC	25	35	32	38	57
V2-SA	397	497	490	750+	750+
V2-SB	427	620	750+	750+	750+
V2-SC	412	487	530	750+	750+
V3-SA	133	333	750+	750+	750+
V3-SB	167	360	750+	750+	750+
V3-SC	185	460	750+	750+	750+
V4-SA	20	25	38	107	173
V4-SB	12	25	28	98	183
V4-SC	17	12	22	52	117
V5-SA	58	170	290	750+	750+
V5-SB	95	167	750+	750+	750+
V5-SC	113	137	750+	750+	750+
V6-SA	0	0	10	47	292
V6-SB	0	0	7	73	323
V6-SC	0	0	3	58	283
V7 - SA	273	283	350	550	593
V7-SB	332	363	300	527	517
V7-SC	227	247	197	507	620
V8-SA	108	260	400	750+	750+
V8-SB	137	357	543	750+	750+
V8-SC	157	340	487	750+	750+

Table C4

Results of UCS, Bulk Density, and Permeability, Conducted
on Treated Frontier Hard Chrome Fill

				Bulk Density	Volume Increase	Permeability
Vendor/F	Replicate	Average	UCS, psi	pcf		cm/sec
Vendor]						
A	1	NA		140		NA
	2	NA		142		NA
	3	NA	NA	145	15	NA
В	1	NA	•	148		6.82E-07
	2	NA		149		6.62E-07
	3	NA	NA	146	13	6.13E-07
С	ī	NA	****	143	13	9.60E-07
•	1 2	NA.		145		8.38E-07
	3	NA	NA	146	21	1.25E-06
		NA.	NA.	140	21	1.252-00
Vendor 2						
Α	ì	467		124		2.90E-05
	2	102		128		3,01E-05
	3	124	231	123	44	3.21E-05
В	1	131		118		1.64E-04
	2	100		119		1.62E-04
	3	122	118	127	56	1.56E-04
С	1	NA		NA		3.75E-05
	2	105		129		3.38E-05
	3	NA	105*	NA	52	3.71E-05
Vendor 3	,					
A	1	486		117		2.87E-06
	2	496		117		
	3	382	455	117	74	2.71E-06
В	í	552	425	122	74	3.10E-06
D	2	462				1.51E-06
	3	429	481	120		1.35E-06
С	1	621	461	121	69	1.38E-06
· ·	2	446		123		1.68E-06
	3	627	565	125 126	62	1.55E-06 1.63E-06
Vendor 4			343	120	02	1,035-00
		262		100		
A	1	353		106		1.05E-05
	2	389	2.5	111		1.04E-05
73	3	311	351	101	89	9.76E-06
В	1	371		100		8.13E-06
	2	411		99		6.90E-06
_	3	367	383	100	99	6.43E-06
С	1	141		100		9.47E-07
	2	171		97		8.40E-07
	3	146	153	98	99	1.03E-06

Table (4 (Concluded)

Vendor	/Replicate	Average	UCS, psi	Bulk Density pcf	Volume Increase	Permombility cm/sec
Vendor						
A	1	5.00		7.00		0 100 03
A	2	562		109		2.18E-07
	2	643		106		2.36E-07
	3	655	620	111	99	2.45E-07
В	1	251		109		3.40E-06
	2 3	545		111		3.58E-06
	3	176	324	112	98	3.42E-06
С	1 2	671		. 109		5.09E-06
	2	664		110		4.54E-06
	3	698	678	111	95	5.145-06
Vendor	_6					
A	1	157		112		1.79E-05
	2	155		106		1.86E-05
	3	151	154	108	68	1.72E-05
В	1	213		116		7.41E-06
	2	208		109		7.42E-06
	3	192	204	110	64	7.53E-06
С	1	94		114		6.19E-06
	2	92	·	114		6.65E-06
	3	104	97	110	61	6.24E-06
Vendor	Z					
Α	1	223		126		1.26E-05
	2	188		118		1.16E-05
	3	175	195	125	70	1.09E-05
В	1	88		125		1.15E-06
	2	89		123		8.44E-07
	3	198	125	120	70	1.00E-06
С	1	179		126		1.45E-06
	2	153		117		1.29E-06
	3	182	171	126	68	1.29E-06
Vendor	8					
A	1	1,233		120		1.53E-07
	2	1,269		111		9.74E-08
	3	1,068	1,190	119	93	9.44E-08
В	1	1,189	-,	119		3.67E-06
	2	1,050		112		2.80E-06
	3	1,285	1,175	117	95	2.52E-06
С	1	1,233	-,	124		E.JEE-00
	2	774		111		
	3	1,090	1,032	116	90	

Table C5
Results of Wet/Dry Tests Conducted
on Frontier Hard Chrome Fill

Relative Mass Loss Calculations	tfons	,				8 100	1 Loss - Cycle No	cle No	1 1	c	9	-		Total
Ret	Revicate	-	7		7	4	٥	-				1	77	1807
Vendor 1 Test														
1	, 1	NA												NA
	2	100												100
	٣	100												100
Control														;
		NA												EIA 100
	2	100												100
	3	100												100
Vendor 2														
Test					,	;	,	ć	6	ć	č	•	c	33
		0.08	0.04	0.04	0.04	ن. 0	0	0	0.04	· ·	0.04	> (;	7.0
		0	0	0.08	0.04	0	0	0	0.08	0.08	0	0	0.04	0.31
		0.04	0.04	0.04	0.04	0	0	0.08	0.04	0.04	0	0	0	0.32
Control		ć	ć	ò	ć	c	c	2	0 13	70 0	c	c	c	0,40
		0.0	20.0	0.0	3 6	2	,	,	90	70.0		0.04	· C	0.47
		0.08	0.0	50.0	3 6	3 6	> <	> <	80.0	80.0	500		· c	0.40
		0.08	0.04	0.04	0.04	0.04	>	>	÷	9.00		>	>	•
Vendor 3														
Test		ò	•	•	0	ć	ò	_	c	_	c	c	C	0.21
		0.0	; > c	> <	5	3 3		, ,	, ,	, ,	5		50 0	0.26
		0	0.04	>	>	50.0	0.00	> 0	;	> 0		ò	;	
		0.04	0	0	0	0	0.08	0	0.04	>	>	0.04	>	77.0
Control		,	•	,	ć	•	3	•	č	c	c	c	c	30
		0.04	60.0	0.04	0.04	>	J. 0	>	† °	5 (> (> <	; ;) (
		0.08	0.08	0	0.04	0.04	0	0	0.08	0	0	0	0.04	0.38
		0.04	0.04	0	0.04	0.04	0	0	0.04	0	0	0	0	0.21
						(Continued)	ued)							
					•		:							

(Sheet 1 of 3)

Table C5 (Continued)

Relative Mass Loss Calculations					do	880	& Loss - Cvole No	9					Total
Replicate Vendor 4 Test	-	2	3	7	4	9	7	8	6	10	7	12	Lost
	0.06	00	0.06	0.06	0	0 0	0.12	90.0	0 (0	0	0	0.36
Control	0.06	0	0.19	0.06	00	0.06	0.06	00	0.06	00	00	00	0.30
	0.06	0.06	0.06	90.0	0 0	00	0.18	0	0 (0	0	0	0.42
Vendor 5	90.0	0	0.13	0.19	0.06	00	90.0	0.00	0 0	0.06	00	00	0.42
	0.11	0.16	0.05	0	0	0.11	0	C	0	0	0	0	0.43
	0.05	0.05	0	0 0	0.05	0.10	0	0	0	0.05	0	0	0.31
Control	0.10	0.10	>	>	5	0.05	0.05	0	0	0.05	0	0	0.34
	0.11	0.11	0	0	0	0.11	0	0		0	0	0	0.33
	0.11	0.11	0.05	0 0	00	0.11	0 0	0 0	0 0	0 0	0.05	0.05	0.49
Vendor 6 Test		!	•	,	>	0.51	5	>	0.05	-	ɔ	0	0.58
	0.06	0.17	0.11	0	0	0	0	90.0	90.0	0	0	0	0.46
Control	0.0	0.11	0.12	00	00	00	0.06	00	0.18 0	0.06	00	00	0.66
	0.06	0 0.28 0.18	0.17	0.11	0.11	000	000	0.06	000	0.06	0.11	000	0.51
) , 	,	>	,	>	5	>	>	5	-	0.35

Table C5 (Concluded)

													Total
Relative Mass					*	9880	Cycle	No.					*
Loss Calculations Replicate		2	M	4	2	5 6 7	7	8	6	10	11	12	Lost
Vendor 7													
Test	6	9	c	C	0.05	c	0	0	0	0	0	0	0.42
	0.32	200	o c	0 14)	0.09	0	0.05	0	0	0.14	0	1.29
	0.23	0.28	0	0	0.09	0.09	0	0.05	0	0	0.05	0	0.78
Control	o c	,	0	20.0	c	0.14	0	0.05	0	0	0.09	0.09	1.01
	0.28	0.23	6	0.0	· c	0.09	0	0.14	0	0.02	0.23	0	1.19
	0.23	0.53	0 23	0.05	0	0.14	0	0	0	0	0.05	0	1.01
•	30.0	7.7		•	,								
Vendor 8													
Test	(•	ò	c	00	C	c	0.04	c	0	0.04	0	0.22
	o (5 (, o	> <		· <	· c			C	0	0	0.09
	0	0	>	>	0.03	>	>	·) (, (<	70 0
	0	0.05	0	0	0.09	0	0	0.09	0	>	0.03	>	77.0
Control	ò	•	ć	c	0	-	-	c	c	0	0.04	0	0.18
	0.04	- (O (> <		· c	· <			C	0.04	0	0.09
	0	-	0	>	† 0.0	>	> '	;		, (•	0 00
	0	0	0	0.04	0.13	0	0	0.04	0	5	2	>	77.0

Table C6 Normalization of Total Chromium Contained

in Frontier Hard Chrome Fill

. 3,

RSD Standard Total Cr	Deviation KSD	16				11 80 6	3			0 24 2	į			6 77 6	!				362	25 362 25	362	362	362	362	362	362	362 23	362 23 23	362 23 196	362 23
Total Cr Standard Deviation	Deviación	252				115	1			0	•			46					237	237	237	237	237	237	237	237	237 24	237 24 24 137	237 24 137	237 24 137
Mean Total Cr	10.187					1277	· · !			1268				1147					1436	1436	1436	1436	1436	1436	1435	1436	1435	1435	1436 190 1438	1435 190 1438
Normalized Total Chromium						1236	1370	1226		1246	1265	1294		1064	1176	1200			1674	1674	1674 1019 1615	1674 1019 1615	1674 1019 1615 1297	1674 1019 1615 1297 1598	1674 1019 1615 1297 1598	1674 1019 1615 1297 1598 997	1674 1019 1615 1297 1598 997	1674 1019 1615 1297 1598 997 1608	1674 1019 1615 1297 1598 997 1608	1674 1019 1615 1297 1598 997 1608 1482
Mean Total Cr		1567				1090				1000				790					963	963	963	963	963	963	963	963	963	963	963	963
Total Cr Conc. (mg/L)		1800	1600	1300		1100	1200	970		1000	1000	1000		740	800	830			1100	1100	1100 690 1100	1100 690 1100	1100 690 1100 800	1100 690 1100 800 970	1100 690 1100 800 970 590	1100 690 1100 800 970 590	1100 690 1100 800 970 590	1100 690 1100 800 970 590 1200	1100 690 1100 800 970 590 1200 1100	1100 690 1100 800 970 590 1100 930
Ha		8.9	8.8	8.8		9.1	9.5	9.5		10		8.6		12	12	12			11	11	11 11	1111	11 11 11	11 11 11 12	11 11 12 12 12	11 11 11 12 12 12	11 11 11 12 12 12 12	11 11 11 12 12 12 12	11 11 12 12 12 12 12	11 11 12 12 12 12 12
Moisture		0.282	0.235	0.282		0.333	0.25	0.37		0.176	0.149	0.136		0.163	0.22	0.176			0.37	0.37	0.37 0.333 0.316	0.37 0.333 0.316	0.37 0.333 0.316 0.235	0.37 0.333 0.316 0.235 0.266	0.37 0.333 0.316 0.235 0.266 0.316	0.37 0.333 0.316 0.235 0.266 0.316	0.37 0.333 0.316 0.235 0.266 0.316	0.37 0.333 0.316 0.235 0.266 0.316 0.408	0.37 0.333 0.316 0.266 0.266 0.316 0.429	0.37 0.333 0.316 0.256 0.266 0.316 0.408 0.429
Replicate	Untreated	1	2	3	Vendor 1	-1	2	9	Vendor 2	1	2	3	Vendor 3	7	2	3	11 1 1	Vendor 4	Vendor 4	Vendor 4	Vendor 4 1 2 3	Vendor 4 1 2 3 Vendor 5	Vendor 4 2 3 Vendor 5	Vendor 4 2 2 3 Vendor 5 2	Vendor 4 2 3 Vendor 5 2 3	Vendor 6 Vendor 5 Vendor 6 Vendor 6	Vendor 6 Vendor 6 Vendor 6 Vendor 6	Vendor 6 Vendor 5 Vendor 6 Vendor 6	Vendor 6 Vendor 5 2 2 2 3 Vendor 6 2 3 Vendor 6	Vendor 4 2 2 3 Vendor 5 2 3 Vendor 6 1 3 3 3 3

Table C6 (Concluded)

	Moisture		Total Cr Conc.	1	Normalized Total	Mean	Total Cr Standard	RSD	Total Cr Standard	Total Cr
Replicate	A)C	Hd	(mg/L)_	Total Cr	Chromium	Total Cr	Deviation		Deviation	RSD &
Vendor 7										
	0.19	10	066	1147	1500	1710	591	52	858	20
2	0.205	10	650		716					
٣	0.136	10	1800		2654					
Vendor 8										
7	0.25	11	099	643	1131	1082	96	15	168	16
2	0.19	11	240		895					
3	0.205	10	750		1220					

Table G7

Results of Total Chromium in the MWEP-1 Conducted on Frontier Hard Chrome Fill

	Mols-		MWEP-1		MWEP-1				NM	1717		
Renlicata	ture	2	Conc.	Mean	Standard	RSD	NMLC	Mean	Standard	RSD	å Efft-	<pre>% Effi- clency</pre>
Untreated		bid	(mg/L)	MWEP	Deviation	de l	(mg/kg)	NMLC	Deviation	*	clency	Mean NMLC
1	0.282	9.1	0.390	0.40	0.0603	15.20	5 000	5 013		,		
2	0.235	9.1	0.460	•		77.67	5.681	0.013	0.661	13		
3	0.282	6	0.340				700.7					
Vendor 1												
-	0.333	10	0.095	0.115	0.0486	28 67	1 380	1 77.9	0	:		į
2	0.25	10	0.079			15:31	1 096	7 + / + 7	0.883	21	72	65
က	0.37	11	0.17				0,77.6				81	
Vendor 2							7./40				37	
	0.176	12	0.13	0.147	0.0153	10 41	1 030	640	6	•		
2	0.149	12	0.15			1	7 100	7/0.7	0.219	11	63	59
3	0.136	12	0.16				2.100				63	
Vendor 3							7/7.7				48	
-	0.163	11	0.08	0.078	0.0330	65 57	1 27.5	1 2/.0		;	;	ļ
2	0.22	11	0.044			10.0	767 0	747.1	0.513	7 t T	ر د ر	75
E)	0.176	11	0.11				1 753				/ 0	
Vendor 4							7.17				09	
-1	0.37	11	0.16	0.130	0.0300	23.08	2 92%	7 217.	S ou	Ċ		ļ
2	0.333	11	0.10)	2	1 760	416.7	0.384	C7	7.5	24
	0.316	11	0.13				2 258				69	
Vendor 5											χ ,	
,	0.235	12	0.13	0.102	0.0491	48.27	2 328	1 858	230 U	F /	í	(
2	0.266	12				•	226.5	7.00	0.00	÷	200	63
С	0.316	12	0.045				0.000				28	
Vendor 6							60.0				90	
-	0.408	12	0.20	0.112	0.0766	68 62	9E7 E	1 005	,,,,	ŗ	į	,
2	0.459	12	0.072			70.00	1 255	1.303	1.330	2	31	62
3	0.333	12	0.063				1.025				8/ 2/	
					3)	(Continued)	^					

C15

Table C7 (Concluded)

Mois- MWE ture Con	1	MWE Con	MWEP-1 Conc. (mg/L)	Mean	MWEP-1 Standar, Deviation	RSD	NMLC (mg/kg)	Mean	NML Standard <u>Devlation</u>	RSD *	& Eff1- clency	<pre>% Effi- clency Mean NMLC</pre>
0.19 11 0.041 0.105 0.1085 0.205 11 0.23 0.136 11 0.043	0.041 0.23 0.043		0.105 0.1085	0.1085		103.71	0.683 3.839 0.681	1.734	1.822	105	86 32 84	65
0.25 11 0.052 0.071 0.0338 0.19 11 0.051 0.205 11 0.11	0.071	0.071				47.58	0.975 0.910 1.988	1.291	0.605	47	80 84 54	74

Table C8
Results of Total Chronium in the TCLP Conducted
on Frontier Hard Chrome Fill

Effi- clency Mean NMLC		-1806	61	45	-27	-472
Bff1- clency		-1317 -1515 -3325	66 54 64	39 73 5	-123 88 -57	-441 -485 -506
NMLC Preci-	33.42	10.13	41.57	39.40	102.69	30.21
NMLC Standard <u>Deviatio</u> n	1.129	6.5232	0.547	0.725	4.414	5.834
Mean NMLC	3.377	64.358	1.317	1.841	4.299	19.310
NMLC (mg/kg)	4.102 3.952 2.077	58.119 63.825 71.130	1.385 12.827 0.738	2.490 1.058 1.976	9.138 0.493 3.266	22.205 23.130 12.594
TCLP RSD	34.12	7.05	42.01	41.27	100.58	32.35
TCLP Standard <u>Deviation</u>	0.05	0.15	0.05	0.02	0.12	0.17
Mean	0.13	2.167	0.047	0.058	0.119	0.527
TCLP Conc (mg/L)	0.160 0.160 0.081	2.000 2.300 2.2	0.049 0.065 0.026	0.08 0.032 0.062	0.25 0.014 0.094	0.62 0.63 0.316
Ha	5.5 5.5 5.6	4.4 4.8 4.8	7.1 6.8 6.7	10 9.4 9.7	7 6.4 5.8	9.6 8 9.2
Mois- ture	0.282 0.235 0.282	0.333 0.25 0.37	0.176 0.149 0.136	0.163 0.22 0.176	0.37 0.333 9.316	0.235 0.266 0.316
TCLP Replicate Untreated	1 2 3 Vendor 1	1 2 3 Vendor 2	1 2 3 Vendor 3	1 2 3 Vendor 4	1 2 3 Vendor 5	327

Table C8 (Continued)

Eff1- clency Mean	6 7	-3947	-1878
% Eff1- clencx	8 75 50	-3717 -3025 -6157	-1545 -1526 -3207
NMLC Prect-	82.81	12.84	3.43
NMLC Standard Deviation	1.500	17.550	2.291
Mean	1.932	136.684	66.815
NMLC (mg/kg)	3.779 0.976 1.041	156.604 136.684 123.500 129.947	67.500 64.260 68.685
TCLP RSD	81.58	12.08	3.15
TCLP Hean Standard TCLP <u>Deviation</u>	0.05	0.50	90.0
Hean ICLP	0.057	4.167	1.833
TCLP Conc	0.11 0.028 0.032	4.700 4.167 3.70 4.100	4.8 1.800 1 4.8 1.800 4.9 1.90
на	2.2 1.2 1.2	4.6 4.5 4.7	6.4 8.4 8.7
Mois- ture	0.408 0.429 0.333	0.19 0.2-5 0.136	0.25 0.19 0.205
TCLP Replicate	Vendor 6 1 2 3	Vendor 7 1 2 2	Vendor 8 1 2 3

Table C9
Normalization of Cr(VI) Contained
In Frontier Hard Chrome Fill

	Moisture		Cr(VI)	Mean	Total Cr Standard	000	Normalized		TWN	NML
Replicate Untreated	ON .	Ha	(1/3r)	Total Cr	Deviation	ne a	Chromium	Mean (NML)	Standard Deviation	RSD
-	0.282		30	32	yt 7	13 63				
2	0.235	8.8	37	;	?	70.61				
~	0.282		29							
Vendor 1										
	0.333	9.1	0.082	0.075	100	12 0%	000	0	,	,
2	0.25	9.5	0.079	0	3	17.04	0.097	0.088	0.01	9
~	0.37	9.5	0.065				0.090			
Vendor 2							0.082			
	0.175	10	2.3	2.0	11	15 53	c		,	
2	0.149		1.7) ;	1.0	17.73	6.7	5.5	0.36	14
•	0.136	8.6	1.9							
Vendor 3							6.3			
	0.163	12	3.3	3.5	96 0	7 56	,	,	•	í
~1	0.22	12	3.4	,			÷ ′	1.0	0.38	_
~	0.176	12	8.6				י י			
Vendor 4							٠.ر			
1	0.37	11	4.4	4.5	0.68	16 91	7 7	,	ò	;
2	0.333	11	3.6)			٠.٥	0.36	1 4
3	0.316	11	4.1				2.0			
Vendor 5							٥.			
,d	0.235	12	5.4	3.6	2.59	71 95	α -	7 7	,	į
∵ ≀	0.266	1.2	6.3				0.0	0.0	5.33	10
٣	0.316	12	1.9				1.0			
Vendor 6							0.7			
-4	0.408	12	4.7	3.6	1.05	76 27	۲,	o <	17.1	ć
2	0.429	12	2.6)) •		, ,	0.	1.41	67
m	0.333	12	3.5				4.6			
				<u> </u>	(Continued)					

Table C9 (Concluded)

NML RSD	79	4
NML Standard Deviation	3.08	0.01
Mean (NML)	8.4	0.144
Normalized fotal Chromium	2.4 8.3 3.7	0.146 0.138 0.149
RSD	63.81	122.47
Total Cr Srandard Drylation	2.04	0.10
ifean Total Cr	3.2	0.086
Cr(VI) Conc. (mg/L)	1.6 5.5 2.5	<0.085 <0.083 <0.089
됩	10 10 10	11 11 10
Moisture	0.19 0.205 0.136	0.25 0.19 0.205
Replicate	Vendor 7 1 2 3	Vendor 8 1 2 3

Table G10

Results of Chromium (VI) in the MWEP-1 Conducted on

Frontier Hard Chrome Fill

	Yols.		MWEP-1		HWEP-1				TAGN			
•	ture		Conc.	Mean	Standard	RSD	CLEN	9	NAL	NAL	er i	- Cate
Replicate		Hd	(mg/f)	MWEP	Devlation	*	(mg/kg)	NMI.C	Standard Deviation	KSD *	Etti-	Efficiency
Untreated										1	1711313	חקרות וופפנו
	0.282	9.1	0.380	0 35	0.035	, 1,	61.0		•			
2	0.282	9.1	0.330)	0.00	71.1	7/0-4	4.4/8	0.398	6		
3	0.282	6	0.350				4.076					
Vendor 1							107.7					
~~	0.333	10	<0.030	<0.029	00.0	0 13	767 0		4	,		
2	0.25	10	<0.027			21.6	0.436	0.443	0.072	91	91	06
3	0.37	11	<0.032				0.373				91	
Vendor 2			!				0.31/				88	
~	0.173	12	0.12	0.147	0 03	15 75	202	6	,	,		
2	0.149	12	0.16			77.73	7.090	7/0.7	0.326	16	65	24
٣	0.136	12	0.16				2.248				4.5	
Vendor 3			•				7/7.7				67	
~1	0.163	11	0.05	0.073	0 041	25.90	736 0	•		į		
2	.022	11	0.051		***	00.55	0.738	1/1.1	0.644	55	87	74
٣	0.176	11	0.12				1.043				79	
Vendor 4							716.1				57	
-	0.37	11	0.13	0.120	0.017	14 41	328 6	1111	6		,	
2	0.333	11	0.10			7	1 760	751.7	0.327	15	51	52
٣	0.316	11	0.13				7 750				57	
Vendor 5							6.4.3				20	
~ -1	0.235	12	0.12	0,101	150 0	80 07	17.0	600	0	:		
2	0.266	12	0.14	•		17.30	7 570	1.833	0.902	67	26	29
3	0.316	12	0.044				2.3/0				37	
Vendor 6							0.040				81	
 4	0.408	12	0.22	0.117	060 0	76 83	טרר נ	,		ŕ	:	
2	0.429	12	0.070		•	70.0	1 220	766.1	1.333	8/	22	26
m	0.333	12	0.060				0.976				70	
					3/	ontinio	4					
					· ·	(papilit piloo)	u)					

Table C10 (Concluded)

Efficiency Mean NMLC	58	87
Effi- clency	75 6 86	90 89 81
NML RSD	06	36
NML Standard Deviation	1.710	0.218
Mean	1.896	0.601
NMLC (mg/kg)	1.233 3.839 0.618	0.506 0.446 0.850
RSD	88.94	36.87
MWEP-1 Standard Deviation	0.102	0.012
Mean	0.114	<0.033
MWEP-1 Conc. (mg/L)	0.074 0.23 0.039	<0.027 <0.025 0.047
Ha	== ==	1111
Mois- ture	0.19 0.205 0.136	0.25 0.19 0.205
Replicate	Vendor 7 1 2 3	Vendor 8 1 2 3

Table Cll
Results of Cr(VI) in the TCLP Conducted
on Frontler Hard Chrome Fill

Effi- clency Mean NMLC		-17	-60	-272	06-	-3760
Effi- clency		-13 -12 -26	-54 -116 -11	-318 -288 -211	-43 -42 -185	-4160 -4879 -2282
NML Pre- cision	8	æ	31	15	777	8
NML Standard Deviation	0.011	0.047	0.250	0.276	0.428	6.504
Mean	0.507	0.594	0.809	1.885	0.965	19.553
NMLC (mg/kg)	0.513 0.494 0.513	0.581 0.555 0.647	0.792 1.068 0.568	2.143 1.918 1.593	0.731 0.704 1.459	21.847 24.598 12.212
TCLP RSD	0.00	0.00	31.46	15.37	46.47	35.09
TCLP Standard Deviation	0.00	0.00	0.01	0.01	0.01	0.19
Mean TCLP	<0.020	<0.020	0.029	0.059	0.027	0.533
Cr(VI) TCLP Conc. (mg/L)	<0.020 <0.020 <0.020	<0.020 <0.020 <0.020	0.028 0.038 <0.020	0.07 0.058 0.05	<0.020 <0.020 0.042	0.61 0.67 0.320
Hd	5.5 5.5 5.6	4.4 4.6 4.8	7.1 6.8 6.7	10 9.4 9.7	7 6.4 5.8	9.6 8 9.2
Mois-	0.282 0.235 0.282	0.333 0.25 0.37	0.176 0.149 0.136	0.163 0.22 0.176	0.37 0.333 0.316	0.235 0.266 0.316
TCLP Replicate Untreated	1 2 3 Vendor 1	1 2 3 Vendor 2	1 2 3 Vendor 3	1 2 3 Vendor 4	1 2 3 Vendor 5	

Table Cll (Concluded)

Effi- clency Mean NMLC	-63	-29	77-
& Effi- ciency	-121 -41 -27	-30 -35 -24	-46 -45 -41
NML Pre- cision	32	ю	က
NML Standard <u>Deviation</u>	0.266	0.019	0.019
Mean	0.827	0.656	0.729
NMLC (mg/kg)	1.134 0.697 0.651	0.666 0.668 0.634	0.750 0.714 0.723
TCLP RSD	30.84	00.00	0.00
TCLP Standard Deviation	0.01	00.00	0.00
Mean	0.024	<0.020	<0.020
Cr(VI) TCLP Conc. (mg/L)	2.2 0 03 1.2 <0.020 1.2 <0.020	4.6 <0.020 4.5 <0.020 4.7 <0.020	4.8 <0.020 4.8 <0.020 4.9 <0.020
Ha	2.2	4.6 4.5 4.7	4.8 4.8 4.9
Mois- ture	0.408 0.429 0.333	0.19 0.205 0.136	0.25 0.19 0.205
TCLP Replicate	Vendor 6 1 0 2 0 3 0	Vendor 7 1 2 3	Vendor 8 1 2 3

APPENDIX D: RESULTS OF PHYSICAL TESTS CONDUCTED ON UNTREATED CLAY

Table D1 Results of Moisture Content Conducted on Clay

Sample	Moisture*
ID	
UC-CA-B1	37.24**
UC-CA-B2	47.94
UC-CA-B3	45.10
UC-CA-B4	47.59
UC-CA-B5	49.73
UC-CA-B6	49.08
UC-CA-B7	45.31
UC-CA-B8	50.17
UC-CA-B9	44.45
UC-CA-B10	43.22
UC-CA-B11	47.62
UC-CB-B1	50.17
UC-CB-B2	40.04**
UC-CB-B3	45.76
UC-CB-B4	48.99
UC-CB-B5	49.26
UC-CB-B6	39.73
UC-CB-B7	47.87
UC-CB-B8	49.21
UC-CB-B9	45.29
UC-CB-B10	44.77
UC-CB-B11	46.40
UC-CC-B1	49.02
UC-CC-B2	46.57
UC-CC-B3	47.37
UC-CC-B4	45.97
UC-CC-B5	46.94
UC-CC-B6	47.09
UC-CC-B7	46.80
UC-CC-B8	46.47
UC-CC-B9	51.99
UC-CC-B10	41.32**
UC-CC-B11	48.97

Moisture based on wet weight/dry solids.
 These buckets were used by WES for initial screening tests and Cr⁺⁶ reduction studies.

Table D2

Particle Size Analysis for Frontier Hard Chrome Clay

Weightg	Sieve Size (in.) or Number	Opening mm	Percent <u>Finer</u>	Cumulative <u>Percent</u>
		Clay Replicate 1		
0.00	3	75.00	100.00	0.00
9.90	2	50.00	99.90	0.10
164.90	1.5	37.50	98.00	2.00
87.10	1	25.00	97.10	2.90
97.10	3/4	19.10	96.00	4.00
190.30	1/2	12.50	93.80	6.20
156.70	3/8	9.50	92.10	7.90
166.20	No. 3	6.35	90.20	9.80
109.00	No. 4	4.75	89.00	11.00
1.30	No. 6	3.35	87.40	12.60
2.70	No. 10	2.00	85.70	14.30
3.80	No. 16	1.18	84.40	15.60
4.50	No. 20	0.85	83.60	16.40
5.10	No. 30	0.60	82.90	17.10
5.90	No. 40	0.43	81.90	18.10
6.90	No. 50	0.30	80.70	19.30
7.60	No. 70	0.21	79.90	20.10
8.30	No. 100	0.15	79.00	21.00
9.00	No. 140	0.11	78.20	21.80
10.10	No. 200	0.08	76.90	23.20

(Sheet 1 of 3)

Table D2 (Continued)

Weight	Sieve Size (in.) or Number	Openingmm	Percent Finer	Cumulative Percent
		Clay Replicate 2		
0.00	2	50.00	100.00	0.00
120.10	1.5	37.50	98.20	1.80
23.60	1	25.00	97.90	2.10
176.60	3/4	19.10	95.30	4.70
211.40	1/2	12.50	92.20	7.80
111.60	3/8	9.50	90.60	9.40
161.00	No. 3	6.35	88.20	11.80
82.10	No. 4	4.75	87.00	13.00
1.80	No. 6	3.35	85.20	14.80
4.20	No. 10	2.00	82.80	17.20
5.60	No. 16	1.18	81.40	18.60
6.40	No. 20	0.85	80.60	19.40
7.20	No. 30	0.60	79.80	20.20
8.10	No. 40	0.43	78.90	21.10
9.30	No. 50	0.30	77.70	22.30
10.20	No. 70	0.21	76.80	23.20
11.00	No. 100	0.15	76.00	24.00
11.70	No. 140	0.11	75.40	24.60
12.80	No. 200	0.08	74.30	25.70

2.65

(Continued)

(Sheet 2 of 3)

Liquid limit - 57
Plasticity limit - 32
Plasticity index - 25
Specific gravity - 2. % Gravel - 13.0 % Sand = 12.7
% Fines = 74.3

Table D2 (Concluded)

Weight	Sieve Size (in.) or Number	Openingmm_	Percent Finer	Cumulative Percent
		Clay Replicate 3		
0.00	3	75.00	100.00	0.00
138.30	2	50.00	97.90	2.10
0.00	1.5	37.50	97.90	2.10
73.30	1	25.00	96.80	3.20
146.10	3/4	19.10	94.60	5.40
199.60	1/2	12.50	91.50	8.50
140.70	3/8	9.50	89.40	10.60
125.70	No. 6	3.35	87.50	12.50
79.90	No. 4	4.75	86.20	13.80
1.00	No. 6	3.35	85.00	15.00
2.50	No. 10	2.00	83.10	16.90
3.50	No. 16	1.18	81.80	18.20
4.10	No. 20	0.85	81.10	18.90
4.80	No. 30	0.60	80.20	19.80
5.50	No. 40	0.43	79.30	20.70
6.20	No. 50	0.30	78.40	21.60
7.00	No. 70	0.21	77.40	22.60
7.60	No. 100	0.15	76.70	23.20
8.00	No. 140	0.11	76.20	23.80
8.80	No. 200	0.08	75.20	24.80
0.00				

__avel ~ 13.8 Sand - 11.1

% Fines - 75.2

59 Liquid limit -

32 27 Plasticity limit Plasticity index Specific gravity -

2.65

(Sheet 3 of 3)

Table D3

Moisture Content* of Frontier Hard Chrome Clay

					Cont	ainer N	umber				
Replicate	1	_2	_3	_4		_6		_8	9	_10_	_11_
A	37.2	47.9	45.1	47.6	49.7	49.1	45.3	50.2	44.4	43.2	47.6
				Ave	rage:	42.1					
В	50.2	40.0	45.8	49.0	49.3	39.7	47.9	49.2	45.3	44.8	46.4
				Ave	rage:	46:1					
С	49.0	46.6	47.4	46.0	46.9	47.1	46.8	46.5	52.0	41.3	49.0
				Ave	rage :	47.1					

Overall clay average: 45.1

^{*} Expressed as ratio of water content to content of dry material.

APPENDIX E: RESULTS OF PHYSICAL AND CHEMICAL TESTS ON TREATED CLAY

Table El

Results of the Wet/Dry Test Conducted on

Frontier Hard Chrome Clay

Vendor	<u>Sample</u>	<u>Replicate</u>	Total % Lost
1	Test		100.00
1	resc	1 2	100.00
		2	100.00
	Control	3 1	100.00
	Concrot	2	100.00
		3	100.00
2	Test	1	0.46
	<u> </u>	$\tilde{2}$	0.61
		3	0.68
	Control	i	0.23
		2	0.73
		3	0.72
3	Test	1	0.44
		2	0.45
		3	0.72
	Control	i	1.10
		2	2.32
		3	0.87
4	Test	1	3.33
		2	0.85
		3	1.68
	Control	1	2.76
		2	0.64
		3	1.54
5	Test	1	0.38
		2	0.30
		3	0.30
	Control	1	0,53
		2	0.61
		3	0.45
6	Test	1	2.10
		2	1.01
		3	1.13
	Control	1	1.22
		2	1,52
		3	1.09

Table El (Concluded)

			Total
<u>Vendor</u>	Sample	<u>Replicate</u>	§ Lost
7	Test	1	1.12
•		2	0.46
		3	0.23
	Control	1	1.18
		2	0.62
		3	0.45
8	Test	1	0.23
		2	0.28
		3	0.28
	Control	1	0.28
		2	0.23
		3	0.33

Table E2

Results of Moisture Content. Specific Gravity, and Slump

Tests Conducted on Frontier Hard Chrome Clay

Vendor	Repl	<u>icate</u>	Moisture %	Specific Gravity	Slump _in.
1	Α	1	52.21	2.72	6
•	Α	2	53.27	2.12	0
		3	52.36		
	В	1	49.95	2.73	5
	D	2	50.01	2.73	,
		3	50.11		
	С	1	54.02	2.76	6 25
	C	2	53.29	2.79	6.25
		3			
		3	52.84		
2	Α	1	22,50	2.8	0
		2	22.92		
		3	21.56		
	В	1	23.05	2.79	0
		2	25.76		
		3	24.98		
	С	1	22.99	2.8	0
		2	24.54	-,-	-
		3	24.57		
3	Α	1	36.05	2.62	0
		2	35.72		
		3	36.40		
	В	1	32.85	2.6	0
		2	31.68		
		3	35.82		
	С	1	33.34	2.61	0
		2	33.32		-
		2 3	33.56		
4	Α	1	49.08	2.9	0
		2	49.33		-
		3	48.94		
	В	1	34.28	2.9	0
		2	33.78	-	•
		3	33.76		
	С	1	49.26	2.92	0
		2	48.94		Ū
		3	53,50		

Table E2 (Concluded)

Vendor	Repl	icate	Moisture	Specific Gravity	Slump _in.
5	Α	1	63.72	2.74	0.5
-	••	$\bar{2}$	40.48		
		2 3	40.86		
	В	1	24.77		0.5
		1 2 3 1	43.19		
		3	41.01		
	С	1	45.64	2.74	0
		2	45.41		
		2	45.68		
6	A	1	66.98	2.78	5
		2	66.34		
		2 3 1	67.11		
	В	1	61.47	2.78	5
		2	60.73		
		•	. 60.63		
	С		62.55	2.8	6
		1 2 3	63.07		
		3	62.30		
7	Α	1	34.46	2.7	0
		2	34.60		
		3	34.59		
	В	1	31.32	2.72	0
		2	31.35		
•		3	31.79		
	С	1	33.76	2.73	0
		2 3	30.92		
		3	31.26		
8	Α	1	29.24	2.78	0
		2	29.44		
		3	29.42		
	В	1	29.72	2.78	0
		2	29.61		
		3 1	30.02		
	С	1	26.30	2.79	0
		2	28.17		
		3	27.95		

Table E3

Results of Set Time Tests Conducted on

Frontier Hard Chrome Clay

		Ave	erage Cone Inde (Time, hr		
Sample					
ID	_2_	_4_	8_	24	_48_
V1-CA	15	40	30	35	45
V1-CB	8	38	30	37	32
V1-CC	30	37	22	32	38
V2-CA	313	347	407	750+	750+
V2-CB	283	317	353	633	700
V2-CC	257	320	353	560	700
V3-CA	92	103	167	323	567
V3-CB	28	53	58	90	137
V3-CC	48	88	127	220	273
V4-CA	30	53	40	42	103
V4-CB	23	42	42	68	103
V4-CC	12	12	18	32	43
V5-CA	140	227	750+	750+	750+
V5-CB	97	310	750+	750+	750+
V5-CC	130	250	750+	750+	750+
V6-CA	0	0	32	165	170
V6-CB	0	0	25	133	170
V6-CC	0	0	15	133	167
V7 - CA	68	110	150	200	343
V7-CB	225	330	367	420	727
V7-CC	200	257	270	393	513
V8-CA	97	207	360	750+	750+
V8-CB	102	233	343	750+	750+
V8-CC	123	247	320	750+	750+

Table E4

Results of UCS, Bulk Density, and Permeability, Conducted

on Treate: Frontier Hard Chrome Clay

Vendor/Replicate Average UCS, psi pcf % cm/sec Yendor 1 A 1 NA 120 8.56E-05 2 NA 121 7.35E-05 3 NA NA 121 29 6.77E-05 B 1 NA 126 6.65E-07 3.11E-07 3 NA NA 124 3.11E-07 3.11E-07 3 NA NA 122 28 4.63E-07 C 1 NA 121 9.07E-07 2 NA 120 1.95E-06 3.1E-07 2 NA 120 1.95E-06 3.1A-3E-06 2 NA 123 33 1.43E-06 Vendor 2 A 1 243 108 7.24E-06 B 1 264 108 2.75E-06 2.75E-06 B 1 264 108 2.75E-06 2.61E-06 C 1 200 11					Bulk	Volume Increase	Permeability
A 1 NA 120 8.56E-05	Vendor/Repl	icate	Average	UCS, psi	Density pcf		-
2 NA 121 7.35E-05 B 1 NA NA 121 29 6.77E-05 B 1 NA 126 6.65E-07 2 NA 124 3.11E-07 3 NA NA 122 28 4.63E-07 C 1 NA 121 9.07E-06 2 NA 120 1.95E-06 3 NA NA NA 123 33 1.43E-06 Vendor 2 A 1 243 108 7.24E-06 A 2 283 110 9.13E-06 B 1 264 108 2.75E-06 B 1 264 108 2.75E-06 C 1 200 110 51 6.53E-06 C 1 200 110 51 6.53E-06 C 1 200 110 51 6.34E-06 C 1 200 110 51 6.34E-06 C 1 200 110 53.4E-06 C 2 198 108 4.05E-06 B 1 4.64 271 112 56 2.61E-06 C 2 198 108 4.05E-06 B 1 264 271 112 56 2.61E-06 C 2 198 108 4.05E-06 B 1 34 4.05E-06 B 1 34 4.05E-06 C 2 198 108 7.24E-06 C 1 100 110 6.34E-06 C 2 198 108 7.24E-06 C 2 198 108 7.24E-06 C 1 100 7.53E-05 C 1 161 103 7.56E-05 C 2 22 105 6.66E-07 C 2 247 101 7.53E-05 C 1 61 103 7.56E-05 C 2 47 101 7.53E-05 C 1 61 103 7.56E-05 C 1 61 104 105 7.53E-05 C 1 62E-07 C 1 63 6.17E-07 C 1 6.59E-07 C 1 6.59E-07 C 1 6.69E-03 C 1 166 110 1.44E-06 C 1 168 9.77E-07	Vendor 1						
2 NA 121 7.35E-05 B 1 NA NA 121 29 6.77E-05 B 1 NA 126 665E-07 2 NA 124 3.11E-07 3 NA NA NA 122 28 4.63E-07 C 1 NA 121 9.07E-06 2 NA 120 1.95E-06 3 NA NA NA 123 33 1.43E-06 Vendor 2 A 1 243 108 7.24E-06 A 2 283 110 9.13E-06 B 1 264 108 2.75E-06 B 1 264 108 2.75E-06 C 1 200 110 51 6.53E-06 C 2 285 111 2.47E-06 C 1 200 110 52 3.4E-06 C 1 200 110 53.4E-06 C 2 198 108 4.05E-06 B 1 264 271 112 56 2.61E-06 C 2 198 108 4.05E-06 B 1 246 271 110 56 2.61E-06 C 2 198 108 4.05E-06 B 1 34 4.05E-06 B 1 34 4.05E-06 C 2 198 108 4.05E-06 C 2 198 108 7.24E-06 C 2 198 108 7.24E-06 C 1 100 7.53E-05 C 1 161 103 7.56E-05 C 2 22 105 6.66E-07 C 2 22 105 6.66E-07 C 1 61 103 7.56E-05 C 1 61 104 105 7.53E-05 C 1 61 106 107 7.53E-05 C 1 161 107 7.53E-05 C 1 161 107 7.53E-05 C 1 166 110 114E-06 C 1 166	Α	1	NA		120		8.56E-05
B 1 NA NA 121 29 6.77E-05 B 1 NA 126 6.65E-07 C 1 NA 121 9.07E-06 C 1 NA 121 9.07E-06 C 1 NA 121 9.07E-06 C 1 NA 122 28 4.63E-07 C 1 NA 120 1.95E-06 C 1 NA 120 1.95E-06 C 1 NA NA 123 33 1.43E-06 Vendor 2		2					
B		3		NA		29	
2	В			2.02			
C 1 NA 121 9.07E-07 2 NA 120 1.95E-06 3 NA NA NA 123 33 1.43E-06 Vendor 2							
C 1 NA 121 9.07E-07 2 NA 120 1.95E-06 3 NA NA NA 123 33 1.43E-06 Vendor 2		3		NA		28	
1.95E-06 3 NA	С	1		• • • • • • • • • • • • • • • • • • • •			
Vendor 2 A 1 243 108 7.24E-06 2 283 110 9.13E-06 3 272 266 110 51 6.53E-06 B 1 264 108 2.75E-06 2 285 111 2.47E-06 3 264 271 112 56 2.61E-06 C 1 200 110 6.34E-06 2 198 108 4.05E-06 3 203 200 113 46 4.22E-06 Vendor 3 A 1 101 102 5.52E-08 1.38E-07 B 1 34 105 1.38E-07 6.69E-08 B 1 34 102 77 6.69E-08 B 1 34 103 9.13E-07 6.66E-07 3 NA 28* NA 79 7.19E-07 C 1 61 103 7.56E-05 2 47 101 7.55E-05							
A 1 243 108 7.24E-06 2 283 110 9.13E-06 B 1 264 108 2.75E-06 C 2 285 111 2.47E-06 C 1 200 110 6.34E-06 C 1 200 110 7.55E-06 C 1 200 110 7.55E-05 C 1 46 105 7.66E-07 C 1 61 103 9.13E-07 C 1 61 103 7.56E-05 C 2 22 105 6.66E-07 C 1 61 103 7.56E-05 C 2 47 101 7.53E-05 C 2 47 101 7.53E-05 C 2 92 98 1.69E-05 C 2 92 98 1.69E-05 C 3 83 86 96 86 1.78E-05 C 1 61 109 5.62E-07 C 2 151 109 5.62E-07 C 2 151 109 5.62E-07 C 2 151 109 5.62E-07 C 1 16 110 111 63 6.17E-07 C 1 16 110 1.44E-06		3		NA		33	
2 283	<u>Vendor 2</u>						
2 283	Α	1	243		108		7.24E-06
B 1 264 108 2.75E-06							
B 1 264 108 2.75E-06		3		266		51	
2 285 111 2.47E-06 3 264 271 112 56 2.61E-06 C 1 200 110 6.34E-06 2 198 108 4.05E-06 3 203 200 113 46 4.22E-06 Vendor 3 A 1 101 102 5.52E-08 2 146 105 77 6.69E-08 B 1 34 103 9.13E-07 2 22 105 6.66E-07 3 NA 28* NA 79 7.19E-07 C 1 61 61 103 7.56E-05 2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Vendor 4 A 1 86 91 7.53E-05 3 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 111 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07	В	1					
C 1 200 110 6,34E-06 2 198 108 4.05E-06 2 198 108 4.05E-06 3 203 200 113 46 4.22E-06 Vendor 3 A 1 101 102 5.52E-08 2 146 105 1.38E-07 3 125 124 102 77 6.69E-08 B 1 34 103 9.13E-07 2 22 105 6.66E-07 3 NA 28* NA 79 7.19E-07 C 1 61 61 103 7.56E-05 2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Vendor 4 A 1 84 91 7.72E-05 3 83 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 111 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07		2					
2		3	264	271		56	
3 203 200 113 46 4.22E-06	С	1	200		110		6.34E-06
Vendor 3 A 1 101 102 5.52E-08 2 146 105 1.38E-07 3 125 124 102 77 6.69E-08 B 1 34 103 9.13E-07 2 22 105 6.66E-07 3 NA 28* NA 79 7.19E-07 C 1 61 103 7.56E-05 2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Jendor 4 A 1 84 91 1.72E-05 3 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 117 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07		2			108		4.05E-06
A 1 101 102 5.52E-08 2 146 105 1.38E-07 3 125 124 102 77 6.69E-08 B 1 34 103 9.13E-07 2 22 105 6.66E-07 3 NA 28* NA 79 7.19E-07 C 1 61 103 7.56E-05 2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Pendor 4 A 1 84 91 1.72E-05 2 92 98 1.69E-05 3 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 112 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07		3	203	200	113	46	4.22E-06
2 146 105 1.38E-07 3 125 124 102 77 6.69E-08 B 1 34 103 9.13E-07 2 22 105 6.66E-07 3 NA 28* NA 79 7.19E-07 C 1 61 103 7.56E-05 2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Vendor 4 A 1 84 91 1.72E-05 2 92 98 1.69E-05 3 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 111 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07	<u>Vendor 3</u>						
B 1 34 103 9.13E-07 2 22 105 6.66E-07 3 NA 28* NA 79 7.19E-07 C 1 61 103 7.56E-05 2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Vendor 4 A 1 86 91 1.72E-05 2 92 98 1.69E-05 3 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 111 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07	A	1	101		102		5.52E-08
B 1 34 103 9.13E-07 2 22 105 6.66E-07 3 NA 28* NA 79 7.19E-07 C 1 61 103 7.56E-05 2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Vendor 4 A 1 84 91 1.72E-05 2 92 98 1.69E-05 3 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 111 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07			146		105		1.38E-07
2 22 105 6.66E-07 3 NA 28* NA 79 7.19E-07 C 1 61 103 7.56E-05 2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Vendor 4 A 1 84 91 1.72E-05 2 92 98 1.69E-05 3 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 112 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07			125	124	102	77	6.69E-08
C 1 61 103 7.56E-05 2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Jendor 4	В	1	34		103		9.13E-07
C 1 61 103 7.56E-05 2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Jendor 4	:	2	22		105		6.66E-07
C 1 61 103 7.56E-05 2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Jendor 4			NA	28★	NA	79	7.19E-07
2 47 101 7.53E-05 3 40 49 103 77 7.05E-05 Nendor 4 A 1 84 91 1.72E-05 2 92 98 1.69E-05 3 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 111 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07			61		103		
3 40 49 103 77 7.05E-05 Vandor 4			47				
A 1 86 91 1.72E-05 2 92 98 1.69E-05 3 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 111 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07	3	3	40	49		77	
2 92 98 1.69E-05 3 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 112 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07	Vendor 4						
2 92 98 1.69E-05 3 83 86 96 86 1.78E-05 B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 112 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07	A 1	l	84:		91		1.72E-05
B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 111 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07	2	?	92		98		
B 1 225 112 6.25E-07 2 151 109 5.62E-07 3 198 191 111 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07	3	3	83	86	96	86	
2 151 109 5.62E-07 3 198 191 112 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07							
3 198 191 117 63 6.17E-07 C 1 16 110 1.44E-06 2 6 108 9.77E-07	2	2					
C 1 16 110 1.44E-06 2 6 108 9.77E-07				191		63	
2 6 108 9.77E-07							
- " " " " " " " " " " " " " " " " " " "			16	13	110	62	1.06E-06

Table E4 (Concluded)

				Bulk Density	Volume Increase	Permeability
Vendor/	Replicate	Average	UCS, psi	<u>pcf</u>	§	cm/sec
Vendor	<u>5</u>					
Α	1	462		96		1.32E-03
	2	459		98		9.14E-04
	3	514	478	98	104	6.32E-04
В	1	359		97		NA
_	2	423		101		NA
	3	351	379	98	102	NA
С	1	465	• • • • • • • • • • • • • • • • • • • •	97		2.42E-07
•	2	380		99		1.11E-07
	3	438	428	99	98	1.20E-07
		430	420	33	90	1.205-07
Vendor 6	<u>6</u>					
Α	1	94		95		6.87E-06
	2	92		98		7.18E-06
	3	104	97	94	71	6.83E-06
В	1	69		94		2.47E-06
	2	88		96		2.50E-06
	3	87	81	91	79	2.33E-06
С	1	92		96		4.05E-07
	2	94		96		6.16E-07
	3	93	93	97	70	3.63E-07
Vendor 7	<u>7</u>					
Α	1	93		113		4.19E-06
	2	60		105		4.56E-06
	3	70	74	107	89	4.14E-06
В	1	313	, ,	108	0,7	4.49E-07
_	2	230		106		3.96E-07
	3	198	247	109	96	4.33E-07
С	1	133	47/	106	70	7.06E-07
•	2	135		107		6.54E-07
	3	195	154	105	95	6.30E-07
Vendor 8					75	0.302 07
A	1	459		100		0.005.03
n.	2			109		2.96E-07
	_	456 572	4.07	103	0.7	1.35E-07
מ	3	573	496	103	87	2.10E-07
В	1	554		109		1.10E-07
	2	592		109	e =	1.86E-07
•	3	476	541	107	85	1.88E-07
С	1	534		105		1.27E-06
	2 3	615		109		1.08E-06
	2	767	639	105	84	1.77E-06

Results of Wet/Dry Tests Conducted Table E5

on Frontier Hard Chrome Clay

Loss Galculations	Relati	Relative Mass													Total
Perplicate 1 2 3 4 5 6 7 8 9 10 11 12 LL 1	Loss Cal	culations					36	Loss	- Cycle	No.					عد
or 1 1		Replicate	-	2	3	7	5	9	7	8	6	10	11	12	Lost
1 4.36 1.76 0 0.46 FAIL 2 2.94 1.18 0 0.34 0.17 0 0 14.95 0.84 1.01 FAIL 100 3 FAIL 1 4.14 1.65 0 0.74 0.28 0.37 0 3.22 FAIL 2 3.74 1.36 0 0.68 0.85 0.34 19.96 0.34 4.08 0.17 0.25 0 3 3 FAIL 1 0.05 0.05 0.10 0 0.05 0.05 0.05 0.05 0	endor 1														
2 2.94 1.18 0 0.34 0.17 0 0 14.95 0.84 1.01 FAIL 100 100 100 100 100 100 100 100 100 10		1	4.36	1.76	0	97.0	FAIL								100
3 FAIL 1 4.14 1.65 0 0.74 0.28 0.37 0 3.22 FAIL 2 3.74 1.36 0 0.68 0.85 0.34 19.96 0.34 4.08 0.17 0.25 0 3 3 FAIL 2 0.10 0.05 0.05 0.10 0 0.05 0.05 0.05 0.		2	2.94	1.18	0	0.34	0.17	0	0	14.95	0.84	1.01	FAIL		100
1 4.14 1.65 0 0.74 0.28 0.37 0 3.22 FAIL 2 3.74 1.36 0 0.68 0.85 0.34 19.96 0.34 4.08 0.17 0.25 0 3 3 FAIL 1 0.05 0.05 0.10 0 0.05 0.05 0.05 0.05 0		3	FAIL												100
1 4.14 1.65 0 0.74 0.28 0.37 0 3.22 FAIL 2 3.74 1.36 0 0.68 0.85 0.34 19.96 0.34 4.08 0.17 0.25 0 3 5 FAIL 1 0.05 0.05 0.10 0 0.05 0.05 0.05 0.05 0	Control														
2 3.74 1.36 0 0.68 0.85 0.34 19.96 0.34 4.08 0.17 0.25 0 3 3 FAIL 1 0.05 0.05 0.10 0 0.05 0.10 0 0.05 0.05		,1	4.14	1.65	0	0.74	0.28	0.37	0	3.22	FAIL				100
1 0.05 0.05 0.10 0 0.05 0.05 0.05 0.05 0		7	3.74	1.36	0	0.68	0.85	0.34	19.96	0.34	4.08	0.17	0.25	0	31.76
1 0.05 0.05 0.10 0 0.05 0.05 0.05 0.05 0		ר	TUI												001
1 0.05 0.05 0.10 0 0.05 0.05 0.05 0.05 0	/endor 2 Fest														
2 0.10 0.10 0.0 0 0.05 0.10 0 0.05 0.05 0		1	0.05	0.05	0.10	0	0.05	0.05	0.05	0.05	0	0	0.05	0	97.0
3 0.16 0.05 0 0 0.10 0.05 0.05 0.05 0.05 0.05		2	0.10	0.10	0	0.05	0.10	0	0.05	0.05	0.05	0.05	0	0.05	0.61
ol 1 0.19 0.12 0.12 0.06 0.19 0.12 0 0.12 0.12 0.12 0.06 0 0 0 0.12 0.13 0.05 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		e	0.16	0.05	0	0	0.10	0.05	0.05	0.05	0.05	0.10	0	0.05	0.68
1 0.19 0.12 0.12 0.06 0.19 0.12 0 0.12 0.12 0.12 0.06 0 0 0 0 0.10 0.05 0.05 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Control														
2 0.10 0.05 0.10 0.05 0.10 0.05 0.16 0.10 0 0.05 0.05 0 0 3 0.05 0.05 0.10 0.10 0.10 0.05 0 0.05 0 0.05 0.15 0 1 0.26 0.13 0.07 1.58 0.07 0.13 0 0 0 0 0 0 0 2 0.06 0 0.19 0 0 0.13 0 0 0 0 0 0 0 0 0 0 0 3 0.13 0.13 0.07 0 0.07 0.20 0 0 0 0 0 0.07 0.07		1	0.19	0.12	0.12	90.0	0.19	0.12	0	0.12	0.12	0.12	90.0	0	1.23
3 0.05 0.05 0.10 0.10 0.10 0.05 0 0.05 0 0.05 0.15 0 1 0.26 0.13 0.07 1.58 0.07 0.13 0 0 0 0 0 0 0 2 0.06 0 0.19 0 0 0.13 0 0 0 0.06 0 3 0.13 0.13 0.07 0 0.07 0.20 0 0 0 0 0.07 0.07		2	0.10	0.05	0.10	0.05	0.05	0.16	0.10	0	0.05	0.05	0	0	0.73
1 0.26 0.13 0.07 1.58 0.07 0.13 0.07 0.13 0 0 0 0 0 0 0 0 0 0 0.06 0 0.19 0 0 0.13 0 0 0 0 0 0.06 0 0 0.13 0.13 0.07 0 0.07 0.20 0 0 0 0 0 0.07 0.07		3	0.05	0.05	0.10	0.10	0.10	0.05	0	0.05	0	0.05	0.15	0	0.72
1 0.26 0.13 0.07 1.58 0.07 0.13 0.07 0.13 0 0 0 0 0 0 2 0.06 0 0.19 0 0 0.13 0 0 0 0 0.06 0 0.13 0.07 0.20 0 0 0 0 0 0.07 0.07	ř														
0.06 0 0.19 0 0 0.13 0 0 0 0.06 0 0.13 0.13 0.07 0 0.07 0.20 0 0 0 0 0.07 0.07		~ 1	0.26	0.13	0.07	1.58	0.07	0.13	0.07	0.13	0	0	0	0	2.44
0.13 0.13 0.07 0 0.07 0.20 0 0 0 0 0.07 0.07		2	90.0	0	0.19	0	0	0.13	0	0	0	0	90.0	0	0.45
		٣	0.13	0.13	0.07	0	0.07	0.20	0	0	0	0	0.07	0.07	0.72

(Continued)

(Sheet 1 of 3)

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, 255 255

Table E5 (Continued)

Con Con Con Tess Tess Tess Tess Tess	Relati	Relative Mass													
Prolifeate 1 2 3 4 5 6 7 8 9 10 11 12 12 12 12 12 12 12 12 12 12 12 12	Loss Cal	culations	,				ď	Loss	Cvcle	NO.					Total
Control 1 0.13 0.26 0.13 0.13 0.13 0.13 0.26 0.06 0.06 0.0 0.0 0.00 Vendor 4 1 0.13 0.26 0.26 0.26 0.13 0.13 0.13 0.20 Vendor 5 1 0.20 0.13 0.13 0.13 0.13 0.20 Vendor 6 Control 1 0.15 0.08 0.09 0.09 0.09 0.09 0.09 0.09 0.00 Control 1 0.15 0.08 0.09 0.00 Control 1 0.15 0.08 0.08 0.00 Control 1 0.15 0.08 0.08 0.00 Control 1 0.15 0.08 0.08 0.00 Control 1 0.15 0.08 0.00 Control 1 0.15 0.08 0.00 Control 1 0.15 0.08 0.00 Control 2 0.09 0.00 Control 1 0.15 0.08 0.00 Control 2 0.09 0.00 Control 2 0.09 0.00 Control 3 0.23 0.08 0.00 Control 3 0.24 0.15 0.00 Control 3 0.25 0.00 Control 3 0.25 0.00 Control 3 0.25 0.00 Control 3 0.00 Control Contro		Replicate	-	2]3	77	1.	9	7	8	6	10	-	12	# U
Vendor 4 1 0.13 0.26 0.13 0.13 0.13 0.13 0.20 0.07 0.26 0.20 0.00 0.00 Vendor 4 1 0.13 0.26 0.25 0.28 0.29 0.13 0.20 0.07 0.00 0.00 0.00 0.00 Vendor 4 1 0.30 1.26 0.25 0.23 0.13 0.13 0.13 0.20 0.07 0.00 0.00 0.00 Control 1 0.30 1.26 0.24 0.16 0.24 0.08 0.09 0.19 0.18 0.08 0.08 0.08 0.00 Vendor 5 1 0.30 1.2 0.30 0.09 0.09 0.00 0.09 0.10 0.00 0.00 0.0	Control														3873
Vendor 4 1 0.36 0.26 0.26 0.20 0.13 0.13 0.20 0.07 0.26 0.00 0.00 0.00 Vendor 4 Tost 1 0.30 1.26 0.29 0.37 0.15 0.00 0.15 0.00 0.00 0.00 Control 1 0.90 1.12 0.30 0.00 0.00 0.00 0.00 0.00 0.16 0.00 0.00		1	0.13	0.26	0.13	0.13	0.13	0.26	90.0	C	c	c	_	c	-
Vendor 4 1 0.30 1.26 0.59 0.37 0.15 0 0.30 0.15 0 0 0.07 0 0 0 0.07 Control 1 0.30 1.26 0.59 0.37 0.15 0 0.30 0.15 0 0 0.07 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		2	97.0	0.26	0.26	0.20	0.13	0.20	0.07	0.26	0.20	· c	0 00	0 0	2 33
1 0.30 1.26 0.59 0.37 0.15 0 0.30 0.15 0 0.07 0.07 0.07 0.07 0.07 0.07 0.07 0		0	0.20	0.13	0.13	0	0.13	0.20		0 07	2	· c	2.0)))	20.2
Test 1 0.30 1.26 0.59 0.37 0.15 0 0.30 0.15 0 0.00 0.00 0.00 0.00 0.00 0.00 0	Vendor 4					,	; ;) - -	,	>	>	>	>	>	٥٠٥
Control 1 0.30 1.26 0.59 0.37 0.15 0.0 0.30 0.15 0.0 0.15 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	Test														
Control 2 0.09 0.19 0.19 0.09 0.00 0.19 0.19 0.19		7	0.30	1.26	0.59	0.37	0.15	0	0.30	0 15	c	0 07	70 0	0 0	1 11
Control 1 0.24 0.16 0.24 0.024 0.03 0 0.07 0 0.16 0.06 0.08 0.08 0.06 0.08 0.06 0.06 0.0		2	0.09	0.19	0.19	0.09	0.09	0	0.19		· c)) (9.0	5	0.00
Control 1 0.90 1.12 0.30 0.07 0 0.07 0.07 0.07 0.07 0.00 0.00		3	0.24	0.16	0.24	0.24	0.08		0 16	0 0	80	000	31,0	71 0	0.00
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Control					! •		,			0.0	0.00	0.10	0.10	1.00
Vendor 5 Vendor 5 1 0.15 0.08 0.09 0.09 0.09 0.18 0.16 0.16 0.16 0.16 0.18 0.09 0.18 0.09 0.09 0.09 0.18 Control 1 0.15 0.08 0 0.07 0 0.15 0.08 0 0.015 0 0.07 0 0.07 0 0.00 0.00 0.00 0.00 0.			0.90	1.12	0.30	0.07	0	0.07	0 07	0 07	c	70 0	c	70.0	26 6
Vendor 5 Test 1 0.15 0.08 0.16 0.16 0.16 0.16 0.16 0.16 0.16 0.16		2	0.09	0.09	0.09			60.0	3.0	00.0		· ·	> <	5	0/.7
Vendor 5 Vendor 6 Vendor 6 Vendor 6 Vendor 6 Vendor 7		~	0 33	76.0	31.0	71			0.10	0.0	> 0	,	5	, O	0.64
Test 1 0.15 0.08 0 0 0 0.15 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Vendor	,	7.0	÷7.0	07.0	0.10	•	0.10	>	>	0	0.08	0.08	0.16	1.54
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Test														
2 0 0.07 0 0 0.15 0 0 0 0.15 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		-	0 15	0 08	-	c	-	1	c	•	c	ć	ć	(•
1 0.15 0.08 0.08 0 0.08 0 0.08 0 0.09 0 0.09 0 0.07 0 0 2 0.23 0.08 0 0.08 0 0.08 0 0.08 0 0.08 0 0.08 0 3 0.23 0 0.08 0 0.015 0 0.08 0 0.08 0 0.08 0 1 0 0.37 0.25 0.37 0.25 0 0 0 0.38 0.13 0 0.38 0.13 0 0 2 0 0.38 0.25 0 0 0 0 0.03 0.38 0.13 0 0 0 0.013 0.38 0.13 0		6)	70.0	· c	> <	> 0	0.10	> (> (، د	; • •	-	5	0.38
rol 1 0.15 0.08 0.08 0 0.08 0 0.08 0 0 0.09 0 0 0.08 0 0 0.15 0 0 0.08 0.13 0 0 0 0.08 0 0 0.09 0 0 0.09 0 0 0.09 0 0 0.09 0 0 0.09 0 0 0.09 0 0 0.09 0 0 0.09 0 0 0.09		4 6	> <	0.0))	>	-	0.15	0	0	0	0.07	0	0	0.30
1 0.15 0.08 0.08 0 0 0.08 0 0 0 0.08 0 0 0.08 0 0 0.15 0 0 0.023 0.08 0 0.015 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.09 0 0.09 0 0 0.09 0 0 0.09 0 0 0.09 0 0 0.09 0 0 0.09 0 0 0.09 0 0 0.09 0 0		77	0	0	0.07	0	0	0.15	0	0.07	0	0	0	0	0.30
1 0.15 0.08 0.08 0 0.08 0 0 0.08 0 0 0 0.015 0 2 0.23 0.08 0 0.08 0 0.08 0 0 0.08 0 0 0.08 0 3 0.23 0 0.08 0 0.015 0 0.08 0 0 0.08 0 0 0.08 0 1 0 0.37 0.25 0.37 0.25 0 0 0 0 0 0.49 0 0.37 0 2 0 0.38 0.13 0 0 0 0 0 0 0 0.13 0.38 0.13 0 3 0 0.38 0.25 0 0 0 0 0 0 0.13 0.38 0.13 0	Control														
2 0.23 0.08 0 0.08 0 0.08 0 0 0.08 0 0 0.08 0 0.08 0 0.08 0 0.08 0 0.08 0 0.08 0 0.08 0 0.08 0 0.08 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0 0.08 0 0.09 0		, 1	0.15	0.08	0.08	0	0	0.08	0	0	0	c	31.0	c	53
3 0.23 0 0 0.15 0 0.08 0 0 0.7 0.00 0 0 0 0 0 0 0 0 0 0 0 0 0		2	0.23	0.08	0	0.08	0	0.08	0	0	0 08		80	· c	19
rrn 6 1 0 0.37 0.25 0.37 0.25 0 0 0 0.49 0 0.37 0 2 0 0.38 0.13 0 0 0 0 0 0.38 0.13 0 0 3 0 0.38 0.25 0 0 0 0 0 0.13 0.38 0 0		3	0.23	0	0	0.15	0	0.08		· c	?	· c	9	o	10.0
$\begin{array}{cccccccccccccccccccccccccccccccccccc$) 	1	•	>	>	o	>	>	>	0.40
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Test														
0 0.38 0.13 0 0 0 0 0 0.38 0.13 0 0 0 0 0.38 0.13 0 0 0 0 0 0.38 0.13 0 0 0 0 0 0.13 0.38 0 0 0 0		1	0	0.37	0.25	0.37	0.25	0	c	C	67 0	c	73.0	c	,
0 0.38 0.25 0 0 0 0 0.13 0.38 0 0		7	0	0.38	0.13	0	0	0	0	· c	38	0 13		o c	101
0 0 0 0:13 0:38 0 0 0		~	C	38	75 0	C	c		, ,	,		7	.	.	1.01
		•)	•	0.43	>	>	>	>	0.13	0.38	>	o	၁	1.13

(Sheet 2 of 3)

Table E5 (Concluded)

Relative Mass Loss Calculations	ass					de	Loss -	- Cvcle	No.					Total
Re	Replicate		2	2	7	5	9	7	8	6	10		12	Lost
Control														
	_	0.12	0.37	0.24	0	0	0.12	0	0	0.37		0	0	1.22
	2	0.13	0.51	0.38	0	0	0.13	0	0	0.38		0	0	1.52
	C)	0.24	0.36	0.12	0	0	0	0	0	0.24		0	0	1.09
Vendor 7														
Test														
	_	0.53	0.36	0	0.18	0	90.0	0	0	0	0	0	0	1.12
	2	0	90.0	90.0	0	0	90.0	0	0.12	0.12	0	0	90.0	97.0
	3	0	0.11	0	0	0	0	0	90.0	90.0	0	0	0	0.23
Control														•
	_	0.39	0.28	0.11	90.0	90.0	0.17	0	90.0	90.0	0	0	0	1.18
	2	0.11	0.11	0	0	0	0.11	0	90.0	0	90.0	0.11	90.0	0.62
	3	90.0	0.11	90.0	0	0	90.0	0	90.0	0	0	0	90.0	0.45
Vendor 8														
Test														
	,	0	90.0	0.12	90.0	0	0	0	0	0	0	90.0	90.0	0.35
	2	90.0	90.0	90.0	0	0.11	0	0	0	0	0	0	0	0.28
	e	90.0	90.0	90.0	90.0	90.0	0	0	0	0	0	0	0	0.28
Control														
	-	0	90.0	90.0	0	0.11	0	0	90.0	0	0	90.0	0	0.34
	2	0	90.0	0	0	0.11	90.0	0	0	0	0	0	90.0	0.28
	c	0.11	90.0	0	0	0.11	90.0	0	0	0	0	90.0	0	0.39

Table E6

Normalization of Total Chromium

Contained in Frontier Hard Chrome Clay

			Total Cr		Normalized		Total Cr		Total Cr	
	Moisture		Conc.	Mean	Total	Mean	Standard	RSD	Standard	Total Cr
Replicate	dР	Hd	(mg/L)	Total Cr	Chronium	Total Cr	Deviation	æ	Deviation	RSD &
Untreated										
,,	0.493	7.9	2800	2633			473	18		
2	0.493	7.8	3000							
n	0.351	7.8	2100							
Vendor 1										
-	0.25	10	1700	1867	2066	2386	153	80	277	12
2	0.563	9.5	2000		2550					
3	0.515	9.6	1900		2542					
Vendor 2										
-	0.235	8.3	2200	2267	2870	2944	58	e	98	ю
2	0.299	11	2300		3038					
3	0.282	11	2300		2925					
Vendor 3										
-	0.408	12	1200	1167	1901	1830	58	S	111	9
2	0.351	12	1100		1703					
3	0.389	12	1200		1887					
Vendor 4										
-	0.613	11	2200	2467	3613	4037	643	26	1093	27
2	0.563	11	2000		3220					
3	0.613	11	3200		5279					
Vendor 5										
-	0.538	12	2300	2267	4589	4390	252	11	290	13
2	0.493	12	2000		3727					
'n	0.563	12	2500		4855					
Vendor 6										
7	0.695	12	3500	3567	5041	5140	707	11	621	12
2	0.667	12	3200		4575					
က	0.724	11	4000		5805					
					(Continued)					

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Table E6 (Concluded)

Replicate	Moisture	Ha	Total Cr Conc. (mg/L)	Mean Total Cr	Normalized Total Chronium	Mean Total Cr	Total Cr Standard Deviation	RSD	Total Cr Standard Deviation	Total Cr RSD &
Vendor 7										
1	0.389	11	1400	1300	2683	2440	100	8	223	6
2	0.333	11	1200		2246					
c	0.299	11	1300		2390					
Vendor 8										
7	0.25	11	1300	1267	2145	2125	58	5	89	က
2	0.316	11	1200		2050					
3	0.282	11	1300		2181					

Table E7
Results of Total Chromium in the MWEP-1 Conducted on Frontier Hard Chrome Clay

n d	Mo		MWEP-1 Conc.	Mean	MWEP-1 Standard	RSD	NMLC	Mean	NML Standard	NML RSD	& Effi-	& Effi- ciency
Kepilcate	**	Hd	(mg/L)	MWEP	<u>Deviation</u>	*	(mg/kg)	NMIC	Deviation	*	clency	Mean NMLC
Untreated	-											
-1	0.493	œ	0.081	0.067	0.0164	24.43	1.209	0.977	0.283	29		
2	0.493	9.7	0.071				1.060					
3	0.351	æ	0.049				0.662					
Vendor 1												
1	0.25		0.08	0.112	0.0333	29.81	1.092	1.938	0.755	39	10	86-
2	0.563		0.12				2.176				-105	
e	0.515	11	0.14				2.545				-284	
Vendor 2												
1	0.235	12	0.64	0.757	0.1686	22.28	9.746	11.742	2.550	22	- 706	-1102
2	0.299	12	0.68				10.865				-925	
m	0.282		0.95				14.615				-2108	
Vendor 3												
1	0.408	11	0.13	0.120	0.0100	8.33	2.480	2.249	0.210	6	-105	-130
2	0.351	11	0.12				2.197				-107	
	0.389	11	0.11				2.070				-213	
Vendor 4												
	0.613	11	0.02	0.282	0.2777	98.46	0.341	5.883	5.717	6	72	-502
2	0.563	11	0.57				11.760				-1009	
3	0.563		0.26				5.548				-738	
Vendor 5												
7	0.538		97.0	0.320	0.1400	43.75	10.471	7.207	3.287	949	-766	-638
2	0.493	12	0.18				3.897				-268	
3	0.563	12	0.32				7.252				966-	
Vendor 6												
÷	0.695	11	0.59	0.573	0.0569	9.92	12.201	11.871	1.364	11	-909	-1115
2	0.667		0.51				10.372				-878	
3	0.724	11	0.62				13.040				-1870	
						(Continued)	(par					

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Table E7 (Concluded)

MWEP Deviation % (mg/kg) NMLC Deviation % 0.066 0.0303 45.86 2.118 1.367 0.564 49 0.243 0.0306 12.57 4.928 4.554 0.543 12 4.803 4.803 3.931 3.931		Mois- ture		MWEP-1 Conc.	Mean			NMLC	Mean	NML Standard	NML RSD	å F££1.	& Effi- ciency
0.389 11 0.10 0.066 0.0303 45.86 2.118 1.367 0.564 0.333 11 0.042 0.861 0.299 11 0.056 0.25 11 0.27 0.243 0.0306 12.57 4.928 4.554 0.543 0.316 11 0.25 0.282 11 0.21	Replicate	æ	Ha	(mg/L)	MWEP	Deviation	00	(mg/kg)	NMLC	Deviation		ciency	Mean NMLC
0.389 11 0.10 0.066 0.0303 45.86 2.118 1.367 0.664 0.333 11 0.042 0.299 11 0.056 0.0306 12.57 4.928 4.554 0.543 0.316 11 0.25 11 0.25 11 0.25 11 0.25 11 0.25 11 0.25 11 0.25 11 0.25 11 0.25 11 0.25 0.343 0.316 11 0.25 0.25 0.25 0.316 11 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.25	Vendor 7												
0.333 11 0.042 0.299 11 0.056 8 0.25 11 0.27 0.243 0.0306 12.57 4.928 4.554 0.543 0.316 11 0.25 0.282 11 0.21 3.931	, -d	0.389	11	0.10	990.0		45.86	2.118	1.367		67	-75	-40
0.299 11 0.056 8 0.25 11 0.27 0.243 0.0306 12.57 4.928 4.554 0.543 0.316 11 0.25 0.282 11 0.21	2	0.333	11	0.042				0.861				19	
8 0.25 11 0.27 0.243 0.0306 12.57 4.928 4.554 0.543 0.316 11 0.25 0.282 11 0.21	3	0.299	11	0.056				1.121				69-	
0.27 0.243 0.0306 12.57 4.928 4.554 0.543 0.25 4.803 0.21 3.931	Vendor 8												
0.25		0.25	11	0.27	0.243		12.57	4.928	4.554		12	-705	-366
0.21	2	0.316	11	0.25				4.803				-353	
	3	0.282	11	0.21				3.931				767-	

Table E8
Results of Total Chromium in TCLP Conducted
on Frontier Hard Chrome Clay

Effi- clency Mean NMLC		-2520	51	59	54	-358
& Effi- clency		-1851 -2734 -3189	56 63 30	64 18 97	92 85 -33	-295 -327 -478
NML Pre- cision	16	11	25	92	130	10
NML Standard Devia- tion	0.875	16.611	0.692	2.122	3.360	2.589
Mean	5.603	146.811	2.753	2.303	2.586	25.666
NMLC (mg/kg)	6.569 5.375 4.864	128.150 152.299 159.984	2.863 2.013 3.384	2.366 4.393 0.151	0.511 0.784 6.462	25.949 22.947 28.103
TCLP RSD	11.95	2.66	26.85	93.55	139.85	7.86
TCLP Standard Deviation	0.02	0.12	0.02	90.0	0.11	0.05
Mean TCL.P	0.193	4.333	0.089	0.062	0.080	0.573
Cr(VI) TCLP Conc. (mg/L)	0.220 0.18J 0.180	4.40 4.20 4.40	0.094 0.063 0.110	0.06 0.12 0.004	0.012 0.019 0.21	0.57 0.53 0.62
Ha	5.1 5.2 5.1	4.6	6.8 7.2 7.2	12 12 12	7 8.4 5.8	8.8 9 7.9
Mois- ture	0.493 0.493 0.351	0.25 0.563 0.515	0.235 0.299 0.282	0.408 0.351 0.389	0.613 0.563 0.613	0.538 0.493 0.563
TCLP Replicate Untreated	1 2 3 Vendor 1	1 2 3 Vendor 2	1 2 3 Vendor 3	1 2 3 Vendor 4	1 2 3 Vendor 5	1 2 3 3

Table E8 (Concluded)

& Effi-	clency	NMLC		29				-6097				-2726		
	1 4 4 4 5 T	ciency		55	-29	57		-4608	-6075	-8132		-2400	-2617	-3287
NML	Pre-	CISTOIL		79				14				7		
NML	Standard	tion_		2.563				47.425				10.659		
	i c	NMLC		3.999				347.174				158.328		
	172	(mg/kg)		2.978	6.915	2.103		309.261	331.909	400.352		164.250	146.023	164.711
	TCLP	W.S.D.		65.64				16.38				8.94		
	TCLP	Deviation		ი.06				1.39				0.38		
	2	TCL.P		0.097				8.467				4.233		
Cr(VI)	TCLP	(mg/L)		0.07	0.17	0.05				10.000		4.50	3.80	4.40
		Hd		1.2	1.2	1.3		4.7	5.1	5		5	5.1	5.2
	Mols-	a far		0.695	0.667	0.724		0.389	0.333	0.299		0.25	0.316	0.282
	0 1 J L	Replicate	Vendor 6	1	2	~	Vendor 7	1	7	3	Vendor 8		C1	'n
]	E18

Table E9
Normalization of Cr(VI) Contained
in Frontier Hard Chrome Clay

) 설	gaplicate	Moisture	Hd	Cr(VI) Conc. (mg/L)	Mean Total Cr	Total Cr Standard Deviation	RSD %	Normalized Total Chromium	Mean (NML)	NML Standard Deviation	NML RSD
i.	Untreated		,	,							
	I	0.493	7.9	9.5	10	0.76	7.51				
	2	0.493	7.8	11							
	٣	0.351	7.8	10							
ž	endor 1										
	~	0.25	10	0.023	0.0135	0.01	60.58	0.028	0.017	0.01	26
	2	0.563	9.5	0.0089				0.011			!
	3	0.515	9.6	0.0087				0.012			
ž	endor 2										
	-	0.235	8.3	7.2	7.3	1.01	13.73	9.392	9.509	1.12	12
	2	0.299		4.9				8.453			
_	٣	0.282	11	8.4				10.682			
ž	endor 3										
	, -4	0.408	12	5.4	6.9	1.75	25.45	8.556	10.746	2.60	54
	2	0.351	12	8.8				13.621			
	3	0.389	12	4.9				10.061			
7	endor 4										
	,- -	0.613	11	6.2	8.4	4.89	57.95	10.181	13.775	8.14	59
	2	0.563	ij	5.0				8.050			
	3	0.613	11	14				23.095			
ř	Vendor 5										
		0.538	12	11.0	8.4	16.39	75.66	17.540	13.453	3.99	30
	2		12	6.1				9.560			
	٣	0.563	12	8.2				13.260			
Ve	endor 6										
	-4	0.695	12	14	22	6	43	20.163	31.163	13	42
	2		12	32				45.754			
	3		11	19				27.572			
						(Continued)					

Table E9 (Concluded)

Renlicate	Moisture	He	Cr(VI) Conc.	Mean Total Cr	Total Cr Standard	RSD	Normalized Total Chromium	Mean (NML)	NML Standard Deviation	NML RSD
	,									
Vendor /										
_	0.389	11	3.8	3.6	0.20	5.56	7.282	6.757	0.52	8
2	0.333	11	3.6				6.738			
3	0.299	11	3.4				6.250			
Vendor 8										
,	0.25	11	<0.080	0.083	0.10	122.47	0.132	0.140	0.01	∞
2	0.316	11	<0.089				0.152			
3	0.282	11	<0.081				0.136			

Results of Chromium (VI) in the MWEP-1 Conducted on Frontier Hard Chrome Clay

	Mois-		MWEP-1		MWEP-1				NMI.	NMI	de	9 5661
	ture		Conc.	Mean	Standard	RSD	NMLC	Mean	Standard	RSD	E.F.F	ofenous
Replicate	æ	Hd	(mg/L)	MWEP	Deviation	*	(mg/kg)	NMLC	Deviation	*	clency	Mean NMLC
Untreated										-		200
,	0.493	æ	0.091	0.072	0 017	78 60	1 350	1 053	000	c		
2	0.493	7.6	0.069		· · · · · · · · · · · · · · · · · · ·	10.01	1.030	1.000	0.233	97		
3	0.351	&					0.77					
Vendor 1												
	0.25	10	<0.027	<0.038	0.010	25.92	101	859 0	0 223	2	,	c
2	0.563	10	<0.046) - -		25.50 25.80		0.233	î	7 (ğ
3	0.515	11	<0.041				0 745				L 3	
Vendor 2											n	
	0.235	12	0.65	0.737	0.214	29.00	9 898	11 414	3 1 88	28	620	700
ح 21	0.299	12	0.58				6 267	•	201.	7	670-	+06.
3	0.282	12	0.98				15 076				1859	
Vendor 3							9				0007-	
-	0.408	11	0.09	0.123	0.032	25.80	1 679	2 291	0.550	2,0	2,6	011
2	0.351	11	0.15			•	2.746			† 7	167	011.
3	0.389	11	0.13				2.447				. 218	
Vendor 4							· · ·				077.	
7	0.613	11	<0.052	0.029	0.430	1483.36	1.107	6.001	5 135	86	10	07.7
2	0.563	11	0.55				11.347			}	1003	Ì
3	0.613	11	0.26				5.548				-621	
Vendor 5)				770	
- I	0.538	12	0.30	0.260	0.069	26.65	6.879	5 842	1 684	20	7.03	357
2	0.493	12	0.18)))	3.897		*	67	0.00	CC+-
٣	0.563	12	C. 30				662.9				0/7-	
Vendor 6											co/-	
1	0.695	11	0.62	0.570	0.056	9.77	12,821	11 797	1 273	11	778	1000
2	0.667	11	0.51				10.372		7	1	100	0701-
3	0.724	11	0.58				12.199				-1484	
)	Confined	,,					
						***************************************	•					

Table El0 (Concluded)

	Mois. ture		MWEP-1	Mean	MWEP-1 Standard	RSD	NMLC	Mean	NML Standard		NML & RSD Effi-	& Effi-
Replicate	90	Ha		MWEP	Deviation	de	(mg/kg)	NMLC	Deviation		ciency	Mean NMLC
Vendor 7												
_F i4	0.389	11	0.10	970.0	0.047	101.76	2.118	0.963	1.002	104	-56	6
2	0.333	11	0.021				0.430				58	
e	0.299	11	0.017				0.340				99	
Vendor 8												
	0.25	11	<0.027	<0.028	0.001	3.57	0.493	0.525	0.032	9	99	20
2	0.316	11	<0.029				0.557				97	
3	0.282	11	<0.028				0.524				32	

Table Ell
Results of Cr(VI) in the TCLP Conducted
on Frontier Hard Chrome Clay

Conc. Mean Standard RSD NMLC Mean Standard oision Efficacy Circle Accord Accord MMLC Mean Standard oision Efficacy MIL Deviation Pfill Print Mill <		Mois-		Cr(VI) TCLP		TCLP	TCLP			NML	NML Pre-	عو	8 Effi-
National Continuent	TCLP	ture		Conc.	Mean	Standard	RSD	NMLC	Mean	Standard	cision	Eff1.	ciency
Untraated 1	Replicate	de l	Hd	(mg/L)	TCLP	Deviation	*	(mg/kg)	(NML)	Deviation	35	ciency	Mean NMLC
1 0.493 5.1 <0.020 <0.020 0.00 0.597 0.578 0.033 6 1 0.493 5.1 <0.020 <0.020 0.00 0.00 0.597 0.578 0.033 6 1 0.551 5.2 <0.020 0.020 0.00 0.00 0.583 0.678 0.083 12 2 2 0.563 4.5 <0.020 <0.020 0.0725 0.725 0.727 0.72 0.721 2 0.293 7.2 0.004 0.03 36.69 2.284 2.277 0.803 35 -282 2 0.299 7.2 0.006 0.007 45.89 2.633 5.455 2.446 45 -1065 2 0.351 12 0.19 0.18 0.049 0.045 0.01 41.05 0.852 1.348 0.605 45 -1164 Vendor 5 0.538 8.4 0.049 0.038 0.01 41.05 0.852 1.348 0.605 45 -1164 Vendor 5 0.538 8.4 0.049 0.059 0.056 0.07 10.58 27.770 27.764 3.515 13 -4550 -1960 3 0.503 9.6 0.059 0.056 0.050 0.07 10.58 27.770 27.764 3.515 13 -4550 -1960 3 0.503 7.9 0.059 0.056 0.050 0.07 10.58 27.770 27.764 3.515 13 -4550 -1960 3 0.503 7.9 0.69 0.69 0.69 31.276 0.505 0.5	Untreated												
2 0.493 5.2 < 0.020 Vendor I 0.25 4.6 < 0.020 < 0.000 0.00 0.583 0.678 0.083 12 2 Vendor I 0.553 4.5 < 0.020	-	0.493	5.1	<0.020	<0.020	0.00	0.00	0.597	0.578	0,033	9		
yendor I 0.5540 0.678 0.083 12 2 1 0.25 4.6 <0.020 co.020	2	0.493	5.2	<0.020				0.597					
Vendor 1 Vendor 1 0.25 4.6 6.020	3	0.351	5.1	<0.020				0.540					
1 0.25 4.6 <0.020 <0.020 0.00 0.583 0.678 0.083 12 21 3 0.515 4.7 <0.020	Vendor 1												
2 0.563 4.5 <0.020 Vendor 2 1 0.235 6.8 <0.075 0.707 0.727 Vendor 3 0.515 4.7 <0.020 Vendor 3 0.515 4.7 <0.020 0.528 7.2 0.046 0.07 45.89 2.633 5.455 0.351 12 0.19 Vendor 4 1 0.613 7 <0.020 0.036 0.01 41.05 0.852 1.348 0.61 0.620 0.07 10.58 27.770 1.169 Vendor 5 0.518 8.8 0.61 0.620 0.07 10.58 27.770 1.169 Vendor 5 0.553 8.8 0.61 0.620 0.07 10.58 27.770 2.222 2.4246 0.553 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.563 7.9 0.699 0.564 7.5 0.699 0.565 7.7 0.600 0.07 10.58 27.770 0.7764 3.515 13 1-4550 0.5687	-	0.25	9.4	<0.020	<0.020	0.00	0.00	0.583	0.678	0.083	12	2	-17
3 0.515 4.7 <0.020 Vendor 2 1 0.235 6.8 <0.075 0.074 0.03 36.69 2.284 2.277 0.803 35 -282 2 0.299 7.2 0.046 3 0.282 7.2 0.100 Vendor 3 0.381 12 0.09 0.351 12 0.19 0.382 0.351 12 0.19 0.398 12 0.07 1 0.408 12 0.07 2 0.351 12 0.19 1 0.408 12 0.07 2 0.351 12 0.19 1 0.408 12 0.007 2 0.351 12 0.19 1 0.408 12 0.007 2 0.351 12 0.19 1 0.408 12 0.007 2 0.351 12 0.19 1 0.408 12 0.007 2 0.351 12 0.19 1 0.408 12 0.007 2 0.351 12 0.19 1 0.408 12 0.007 2 0.351 12 0.19 2 0.351 12 0.18 1 0.408 12 0.009 2 0.403 8.4 0.049 2 0.403 9 0.56 2 0.403 9 0.56 3 11.26 3 11.276 3 11.276 3 12.277 3 12.46 4.5 -341 -1165 -1165 -1282 -1469 -1469 -1469 -1469 -1469 -1469 -1469 -1469 -1469 -148	2	0.563	4.5	<0.020				0.725				-21	
Vendor 2 O.235 6.8 <0.075 0.074 0.03 36.69 2.284 2.277 0.803 35 -282 1 0.299 7.2 0.046 0.074 0.03 36.69 2.284 2.277 0.803 35 -282 Vendor 3 0.282 7.2 0.004 0.07 45.89 2.633 5.455 2.446 45 -341 Vendor 3 0.351 12 0.19 0.019 0.07 45.89 2.633 5.455 2.446 45 -341 Vendor 4 0.389 12 0.18 0.018 41.05 0.852 1.348 0.605 45 -43 Vendor 5 0.563 8.4 0.049 0.038 0.01 41.05 0.852 1.348 0.605 45 -43 Vendor 5 0.563 8.8 0.61 0.620 0.07 10.58 27.770 27.764 3.515 13 -4550 2 0.493 <td< td=""><td>Э</td><td>0.515</td><td>4.7</td><td><0.020</td><td></td><td></td><td></td><td>0.727</td><td></td><td></td><td></td><td>-35</td><td></td></td<>	Э	0.515	4.7	<0.020				0.727				-35	
1 0.235 6.8 <0.075 0.074 0.03 36.69 2.284 2.277 0.803 35 -282 2 0.299 7.2 0.046 3 0.282 7.2 0.046 Vendor 3 Vendor 4 1 0.613 7 <0.053 8.4 0.049 3 0.613 5.8 0.018 Vendor 5 0.553 8.8 0.61 0.620 0.07 10.58 27.770 1 0.553 7.9 0.653 7.9 0.69 2 0.284 24.64 3.515 13 13 -4550 1.169 2 0.285													
2 0.299 7.2 0.046 3 0.282 7.2 0.046 45 0.283 1.470 Vendor 3 0.469 Vendor 3 0.282 7.2 0.046 Vendor 4 0.408 12 0.07 0.07 45.89 2.633 5.455 2.446 45 -341 2 0.351 12 0.19 1 0.613 7 <0.020 0.036 0.01 41.05 0.852 1.348 0.605 45 -239 3 0.613 5.8 0.049 1 0.538 8.8 0.61 0.620 0.07 10.58 27.770 27.764 3.515 13 -4550 2 0.493 9 0.56 3 7.9 0.69 3 0.563 7.9 0.69		0.235	6.8	<0.075	0.074	0.03	36.69	2.284	2.277	0.803	35	-282	-294
0.282 7.2 0.100 0.408 12 0.07 45.89 2.633 5.455 2.446 45 -341 0.351 12 0.07 0.07 45.89 2.633 5.455 2.446 45 -341 0.351 12 0.19 0.019 0.018 0.014 41.05 0.852 11.348 0.605 45 -43 0.563 8.4 0.049 0.036 0.01 41.05 0.852 11.348 0.605 45 -43 0.513 8.8 0.049 10.620 0.07 10.58 27.770 27.764 3.515 13 -4550 0.493 9 0.56 0.56 0.69 31.276 3.515 13 -4550 0.563 7.9 0.69 31.276 31.276 3.515 13 -5687		0.299	7.2	9,000				1.470				-146	
0.408 12 0.07 0.07 45.89 2.633 5.455 2.446 45 -341 0.351 12 0.19 0.019 6.956 1.348 0.605 45 -341 0.389 12 0.18 0.036 0.01 41.05 0.852 1.348 0.605 45 -43 0.563 8.4 0.049 0.038 1.169 1.169 1.169 -116 0.518 8.8 0.61 0.620 0.07 10.58 27.770 27.764 3.515 13 -4550 0.493 9 0.56 0.56 0.69 31.276 3.515 13 -5687	3	0.282	7.2	0.100				3.077				697-	
0.408 12 0.07 9.15 0.07 45.89 2.633 5.455 2.446 45 -341 0.351 12 0.19 6.956 2.6956 45 -341 0.389 12 0.18 1.154 1.154 1.154 0.613 7 <0.020	Vendor 3												
0.351 12 0.19 -1065 0.389 12 0.18 -1154 0.613 7 <0.020	1	0.408	12	0.07	9.15	0.07	45.89	2.633	5.455	2.446	45	-341	-843
0.389 12 0.18 6.776 -1154 0.613 7 <0.020	2	0.351	12	0.19				6.956				-1065	
0.613 7 <0.020	3	0.389	12	0.18				6.776				-1154	
0.613 7 <0.020	Vendor 4												
0.563 8.4 0.049 -2.022 0.613 5.8 0.038 1.169 -116 0.538 8.8 0.61 0.620 0.07 10.58 27.770 27.764 3.515 13 -4550 0.493 9 0.56 24.246 31.276 -5687	7	0.613	7	<0.020	0.036	0.01	41.05	0.852	1.348	0.605	45	-43	-133
0.613 5.8 0.038 1.169 -116 0.538 8.8 0.61 0.620 0.07 10.58 27.770 27.764 3.515 13 -4550 0.493 9 0.56 24.246 31.276 -3960 -5687	2	0.563	8.4	0.049				2.022				-239	
0.538 8.8 0.61 0.620 0.07 10.58 27.770 27.764 3.515 13 -4550 0.493 9 0.56 24.246 31.276 31.276 3.515 13 -5687	3	0.613	5.8	0.038				1.169				-116	
0.538 8.8 0.61 0.620 0.07 10.58 27.770 27.764 3.515 13 -4550 0.493 9 0.56 24.246 31.276 31.276 3.515 13 -4550 -3960	Vendor 5												
9 0.56 24.246 -3960 7.9 0.69 31.276 -5687	1	0.538	8.8	0.61	0.620	0.07	10.58	27.770	27.764	3.515	13	-4550	-4701
7.9 0.69 31.276	2	0.493	6	0.56				24.246				-3960	
	9	0.563	7.9	69.0				31.276				-5687	

Table Ell (Concluded)

	OI												
% Effi.	clency Mean NML	-142				747			(-30			
dec	Eff1.	-45	- 315	96-		-42	-37	-48	(-22	-29	- 39	
NML Pre-	cision	29			,	m			ļ	c.			
NML	Standard <u>Deviation</u>	0.939				0.023				0.019			
	Mean (NML)	1.397				0.823				0.749			
	NMLC (mg/kg)	0.889	2.481	0.841		0.847	0.820	0.801		0.730	0.769	0.749	
TCLP	RSD	68.79				0.00				00.0			
TCLP	Standard <u>Deviation</u>	0.02				0.00				0.00			
	Mean TCL.P	0.034				<0.020				<0.020			
Cr(VI) TCLP	Conc. (mg/L)	1.2 0.021	0.061	<0.020		<0.020	<0.020	<0.020		<0.020		<0.020	
	IId	1.2	1.2	1.3		4.7	5.1	2		2	5.1	5.2	
Mois.	ture	0.695	0.667	0.724		0.389	0.333	0.229		0.25	0.316	0.282	
	TCLP Replicate	Vendor 6	2	m	Vendor 7	1	2	c	Vendor 8	1	2	3	• •

APPENDIX F: RADIAN, INC., QUALITY ASSURANCE/QUALITY CONTROL

Table F1
Summary of Blank Results, Frontier Hard Chrome

	True		Det	Measured	*
Date	Value		Flag	Value	Recovery
ethod: ICP Metals by SW6010					
etrix: Solid					
Inalyte: Iron					
ype of Control Sample: Calibration (Control Sample, continued	i			
7-Jui-90	5.000	mg/L		5.020 mg/	/L 100.40
9-Jun-90	5.000	mg/L		5.050 mg/	/L 101.00
9-Jun-90	5.000	mg/L		5.090 mg/	/L 101.80
9-Jun-90	5.000	mg/L		5.160 mg/	/L 101.80
9-Jun-90	5.000	mg/L		5.100 mg/	/L 102.00
9-Jun-90	5.000	mg/L		5.030 mg/	/L 101.80
0-Jun-90	5.000	mg/L		5.130 mg/	L 102.60
0-Jun-90	5.000	mg/L		5.140 mg/	L 102.80
0-Jun-90	5.000	mg/L		5.020 mg/	/L 100.40
0-Jun-90	5.000	mg/L		4.990 mg/	L 99.80
1-Jun-90	5.000	mg/L		5.020 mg/	'L 100.40
1-Jun-90	5.000	mg/L		5.100 mg/	L 102.00
5-Jun-90	5.000	mg/L		5.340 mg/	L 106.80
5-Jun-90	5.000	mg/L		5.210 mg/	L 104.20
1-Jul-90	5.000	mg/L		5.060 mg/	L 101.20
1-Jul-90	5.000	mg/L		5.050 mg/	L 101.00
Z-Jul-90	5.000	mg/L		5.460 mg/	L 109.20
2-Jul- 9 0		mg/L		5.400 mg/	108.00
2-Jul- 9 0		mg/L		5.130 mg/	L 102.60
2- Jul - 9 0		mg/L		5.450 mg/	109.00
2-Jul-90		mg/L		5.010 mg/	
?-Jul-90		mg/L		5.050 mg/	
?-Jul-90		mg/L		5.110 mg/	
2-Jul-90		mg/L		5.120 mg/	
3-Jul-90		mg/L		5.130 mg/	
3-Jul-90		mg/L		5.190 mg/	
7-Jul-90		mg/L		4.960 mg/	
7- Jul -90		mg/L		5.100 mg/	L 102.00
7- Jul - 90		mg/L		5.150 mg/	
7-Jul-90		mg/L		5.040 mg/	100.80
-Jul-90		mg/L	:	200.000 mg/	
-Jut-90		mg/L		48.900 mg/	
-Jul-90		mg/L		47.600 mg/	
- Jul - 90		mg/L		47,900 mg/	
-Jut-90		ma/L		48.500 mg/	
-Jul -90		mg/L		50.600 mg/	-
-Jul-90		mg/L		49.000 mg/	

Table F1 (Continued)

SUMMARY OF BLANK RESULTS FOR MATRIX = MW EP LFACHATE; Submetrix = M/A

Method Type Parameter	Total Number of Blanks	Total Mumber above Detection Limit	Concentration Range Minimum - Maximum	Maximum Detection Limit	Units
Chronium by ICPES					
Field Blank					
Chronium	16	16	0.0030 - 0.067	0.0030	mg/L
Iron by SU6010					
Field Blank					
Iron	16	16	0.210 - 21.0	0.0070	ng/L
ICP Metals by SU6010					
Preparation					
Chronium	4	0		0.0030	ng/L
Iron	4	0		0.0070	mg/L
Lead	3	0		0.042	eng/L
Wickel	3	0		0.015	ng/L
Mickel by SM6010					
Field Blank				_	
Mickel	4	4	0.015 - 0.015	0.015	mg/L
Lead by SW6010					
Field Blank					
Lead	4	4	0.042 - 0.042	0.042	mg/L

Table F1 (Continue)

SUPPLIET OF	BLAHK	RESULTS	FOR	MATRIX	•	SOLID;	Submetrix	■ **-
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Hethod Type		Total Humber of	Total Number	Concentration Range	Maximum Detection	
	Paramet,r	Blanks	Detection Limit	Minimum - Meximum	Limit L	Units
Chrome VI by						
Preparation Chromium		4	0		0.0050 #	ng/L

Table F1 (Continued)

SLEWMARY OF BLANK RESULTS FOR MATRIX = SOLID; Submetrix = M/A

Hethod	Total Number	Total Number	Concentration	Maximum	
T∨ pe	of	sbove	Range	Detection	
Parameter	Blanks	Detection Limit	Minimum - Maximum	Limit	Units
Conductivity (£120.1)					
Method Blank					
Consuctivity	1	0		1.000	umhos/
Preparation	·	· ·		1,000	D-11007
Conductivity	2	0		1.000	umhos/
Chioride by IC (E300.0)					
Method Blank					
Chloride	1	0		0.020	mg/Kg
Preparation					• •
Chloride	2	0		5.000	mg/Kg
ICP Metals by SW6010					
Preparation					
Chromium	11	0		1.000	mç/Kg
Iran	11	1	2.400 - 2.4	4.000	mg/Kg
Lead	11	Ö		5.000	mg/Kg
Nickel	13	0		2.000	mg/Kg
Chrome VI by SW7196					
Field Blank					
Chromium VI	15	, 3	0.0050 - 0.010	0.190	mg/Kg
Preparation		• -			-3/49
Chronium VI	10	0		0.200	mg/Kg
Sulfate by IC (E300.0)					
Preparation					
Sulface	1	0		12.5	mg/Kg

Table F1 (Continued)

SUMMARY OF BLANK RESULTS FOR MATRIX . TREATED; Submotrix . Md

		***********		******
Total Number of Blanks	Total Humber above Detection Limit	Concentration Range Minimum - Kaximum	Naximum Detection Limit	Unit
		-		
4	1	0.0080 - 0.0080	0.020	mg/L
3	à		0.040	ang/L
3			0.050	mg/L
3	0		0.020	mg/L
1	0		0.0050	mg/L
	af	of above Blanks Detection Limit 4 1 3 0 3 0 3 0	of above Range Blanks Detection Limit Minimum - Maximum 4 1 0.0080 - 0.0080 3 0 3 0 3 0 3 0	1

Table F1 (Concluded)

SIMMARY OF	BLANK	RESULTS	FOR	MATRIX =	TREATED:	Submatri	X =	Ť
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Method	Total Number		enseesessessessessesses Concentration	Max imum	
Type	of	above	Range	Detection	
Parameter	Blanks	Detection Limit	Minimum - Meximum	Limit	Units
Arsenic by AA (E206.2)					
Preparation					
Arsenic	2	٥		0.0040	mg/L
Conductivity (6120.1)					
Hethod Blank					
Conductivity	1	O		1.000	ruspos/c
2reparation					
Conductivity	1	0		1.000	umhos/c
Hereury by Cald Vepor AA (E245.1)					
Preparation					
Hercury	1	1	0.00020 - 0.00020		mg/L
CP Metals by SW6010					
Preparation					
Bersum	3	0		0.010	mg/L
Cacinium	3	1	0.0093 - 0.0093	0,0050	mg/L
Chromium	6	1	0.0040 - 0.0040	0.010	mg/L
Iron	5	2	0.040 - 0.081	0.040	mg/L
Lead	6	0		0.050	mg/L
Mickel	5	O		0.020	mg/L
Silver	3	1	0.013 - 0.013	0.010	mg/L
delenium by AA (E270.2)					
Preparation					
Selenium	2	0		0.0050	mg/L
throme VI by SW7196					
Preparation					
Chronium VI	3	0		0.030	mg/L
ulface by IC (£300.0)					
Method Blank					
Sulfate	1	0		0.050	mg/L
Preparation					
Sulfate	1	0		12.0	mg/L

Table F2

Detailed Listing of Blank Results, Frontier Hard Chrome

SLAWARY OF BLANK RESULTS FOR MATRIX = TREATED; Submatrix = M/A Method Total Number Total Number Concentration Maximum Type of Detection above Range Parameter Blanks Detection Limit Minimum - Maximum Limit Units Arsenic by AA (E206.2) Preparation Arsenic 0 0.0040 mg/Kg Chloride by IC (E300.0) Chloride 5,000 mg/Kg ICP Metals by SU6010 Preparation Chronium 3 0.0080 - 0.40 0.300 mg/Kg tron 5 0.060 - 8.9 4.000 mg/Kg Lead 0 5.000 mg/Kg Nickel 2.000 mg/Kg Selenium by AA (E270.2) Preparation Selenium Q 0.00 mg/Kg Chrome VI by SW7196 Preparation Chromium VI 0.0050 mg/Kg Sulface by IC (E300.0)

12.5

mg/Kg

Preparation Sulfate

Table F2 (Continued)

Date	Type of Blank	Detection Flag	Result	Detection Limit	Unit
Metho	d: Chromium by ICPES				
Anaty	te: Chromium				
8-May-90	Field Blank		0.0030	0.0030	my/
5-Hay-90	Field Blank	<5x	0.0030	0.0030	mg/
8-Hay-90	Field Blank	<5x	0.0140	0.0030	mg/
9-May-90	Field Blank		0.0180	0.0030	WG.
9-May-90	Field Blank	<5x	0.0110	0.0030	mg/
9-May-90	Field Blank	∢5 ¥	0.0070	0.0030	mg,
2-Jun-90	Field Blank		0.0269	0.0030	mg/
2-Jun-90		<5x	0.0140	0.0030	mag.
	Field-Blank	<5X	0.0120	0.0030	mg,
2-Jun-90			0.0380	0.0030	mg.
2-Jun-90			0.0030	0.0030	mg.
8-Jun-90	Field Blank	<5x	0.0060	0.0030	mg.
8-Jun-90	Field Blank	<5X	0.0040	0.0030	mg,
8-Jun-90	Field Blank		0.0200	0.0030	mg
3-Jun-90	Field Blank		0.0670	0.0030	mg
			0.0320	0.0030	mg
8-Jun-90	field Blank		0.0220	0.000	•
8-Jun-90		· 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
8-Jun-90	Field Blank Total Humber of Blank Total Humber above De		Concentration Range Maximum Detection L	0.0030 - 0.067	
	Total Number of Blank Total Number above De		Concentration Range	0.0030 - 0.067	
######################################	Total Number of Slane Total Number above De		Concentration Range	0.0030 - 0.067	
Hetho Analy	Total Number of Blank Total Number above De		Concentration Range Maximum Detection L	0.0030 - 0.067	ng
Hetho Analy	Total Number of Blank Total Number above De d: Iron by \$46010 te: Iron		Concentration Range Maximum Detection L	0.0030 - 0.067 imit * 0.0070 0.0070	mg mg
Hetho Analy J-Hay-90 J-May-90	Total Number of Blank Total Number above De d: Iron by \$86010 te: Iron Field Blank		Concentration Range Maximum Detection L	0.0030 - 0.067	
Metho Analy 3-May-90 3-May-90 3-May-90	Total Number of Blank Total Number above De d: Iron by \$86010 te: Iron Field Blank Field Blank		Concentration Range Maximum Detection L 0.2100 0.4200	0.0030 - 0.067 imit * 0.0070 0.0070 0.0070 0.0070	mg mg
Metho Analy 3-May-90 3-May-90 3-May-90	Total Number of Blank Total Number above De d: Iron by \$86010 te: Iron Field Blank Field Blank Field Blank		Concentration Range Maximum Detection L 0.2100 0.4200 0.6600	0.0030 - 0.067 imit * 0.0070 0.0070 0.0070	riq inq inq riq
Metho Analy 3-May-90 3-May-90 3-May-90 7-May-90	Total Number of Blank Total Number above De d: Iron by \$86010 te: Iron Field Blank Field Blank Field Blank Field Blank		0.2100 0.4200 0.6600 3.3000	0.0030 - 0.067 imit * 0.0070 0.0070 0.0070 0.0070	mq mq mq mq
Metho Analy J-May-90 J-May-90 J-May-90 J-May-90 J-May-90	Total Number of Blank Total Number above De d: Iron by Su6010 te: Iron Field Blank		0.2100 0.4200 0.4600 3.3000 0.4800	0.0030 - 0.067 imit * 0.0070 0.0070 0.0070 0.0070 0.0070	mg mg mg mg
Metho Analy J-May-90 J-May-90 J-May-90 J-May-90 J-May-90 J-May-90	Total Number of Blank Total Number above De d: Iron by Su6010 te: Iron Field Blank		0.2100 0.4200 0.6600 3.3000 0.4800 5.8000	0.0030 - 0.067 imit * 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070	may
Metho Analy J-May-90 J-May-90 J-May-90 J-May-90 J-May-90 J-Jun-90 J-Jun-90	Total Number of Blank Total Number above De d: Iron by Su6010 te: Iron Field Blank		0.2100 0.4200 0.6600 3.3000 0.4800 5.8000 1.2000	0.0030 - 0.067 imit * 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070	may
Metho Analy 3-May-90 3-May-90 9-May-90 9-May-90 9-May-90 2-Jun-90 2-Jun-90	Total Number of Blank Total Number above De d: Iron by Su6010 te: Iron Field Blank		0.2100 0.4200 0.6600 3.3000 0.4800 5.8000 1.2000 2.3000	0.0030 - 0.067 imit * 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070	may
Metho Analy J-May-90 J-May-90 J-May-90 J-May-90 J-Jun-90 J-Jun-90 J-Jun-90 J-Jun-90	Total Number of Blank Total Number above De d: Iron by Su6010 te: Iron Field Blank		0.2100 0.4200 0.6600 3.3000 0.4800 5.8000 1.2000 2.3000 2.5000	0.0030 - 0.067 imit * 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070	ng ng
Metho Analy J-May-90 J-May-90 J-May-90 J-May-90 J-May-90 J-Jun-90 J-Jun-90 J-Jun-90 J-Jun-90 J-Jun-90 J-Jun-90	Total Number of Blank Total Number above De d: Iron by Su6010 te: Iron Field Blank		0.2100 0.4200 0.4200 0.6600 3.3000 0.4800 5.8000 1.2000 2.3000 2.5000 21.0000	0.0030 - 0.067 imit * 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070	may
Metho Analy 3-May-90 3-May-90 3-May-90 7-May-90 7-Jun-90 7-Jun-90 1-Jun-90 1-Jun-90 1-Jun-90 1-Jun-90 1-Jun-90 1-Jun-90	Total Number of Blank Total Number above De d: Iron by Su6010 te: Iron Field Blank		0.2100 0.4200 0.6600 3.3000 0.4800 5.8000 1.2000 2.3000 21.0000 3.6000	0.0030 - 0.067 imit * 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070	mag
Anally 8-Nay-90 8-Nay-90 8-Nay-90 9-Nay-90 9-Nay-90 2-Jun-90 2-Jun-90 2-Jun-90 2-Jun-90 8-Jun-90	Total Number of Blank Total Number above De d: Iron by Su6010 te: Iron Field Blank		0.2100 0.4200 0.6600 3.3000 0.4800 5.8000 1.2000 2.3000 21.0000 3.6000 0.3800	0.0030 - 0.067 imit * 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070 0.0070	

Table F2 (Continued)

Date	Type of Blank	Detection Flag	Result	Detection Limit	Unit
Analy	sis for Iron by \$W6010				
	Analyte: Iron continued				
18-Jun-90	Field Blank		1.5000	0.0070	mg/L
	Total Number of Blank	s = 16	Concentration Range	0.210 - 21.0	
	Total Number above De	tection Limit = 16	Maximum Detection L	imit =	
********	***************	######################################	****************	***********	
	i: ICP Metals by \$W6010 et Chromium				
23-May-90	Preparation	MD	0.0030	0.0030	mg/L
	Preparation	ND	0.0030	0.0030	mg/L
2-Jun-90	Preparation	NO	0.0030	0.0030	mg/L
7-Jul-90	Preparation	NO	0.0030	0.0030	mg/L
	Total Number of Blank	1 = 4	Concentration Range	*C	
	Total Number above De	tection Limit = 0	Maximum Defection Li	mit = 0.0030	
	: ICP Metals by \$46010 e: Iron				
•					
	Preparation	жĎ	0.0070	0.0070	mg/L
	Preparation Preparation	MO 	0.0070	0.0070	mg/L
	Preparation	NO NO	0.0070 0.0070	0.0070 0.0070	mg/L mg/L
	Total Number of Blanks	. = 4	Concentration Range	NC NC	
	Total Number above Det	ection Limit = 0	Maximum Detection Li		
M-85-4	. 166 H b. 614010				
	: ICP Metals by 5W6010 e: Lead				
5-Hay-90	Preparation	NO.	0.0420	0.0420	mg/L
1-Jun-90	Preparation	NO	0.0420	0.0420	mg/L
!-Jun-90	Preparation	MO	0.0420	0.0420	mg/L

Table F2 (Continued)

Dat :	Type of Blank	Detection Flag	Result	Detection Limit	Unit
#nnt	sia for ICP Metals by Sw	601g			
	Analyte: Lead continued				
	Total Number of Blank	s = 3	Concentration Ra	nge NC	
	Total Number above De	tection Limit = 0	Maximum Detection	n Limit = 0.042	
Method	d: ICP Metals by SW6010				
Anely	te: Nickel				
:3-Noy+90	Preparation	NO	0.0150	0.0150	mg/
11-Jun-90	Preparation	NO	0.0150	0.0150	mg/
2-Jun-90	Preparation	DM	0.0150	0.0150	mg/
					
	Total Number of Blank	s = 3	Concentration Ra	nge NC	
Hetho	Total Number above De	-	Maximum Detection	n Limit * 0.015	****
Hetho: Analy:	Total Number above De	tection Limit = 0	Maximum Detection	n Limit * 0.015	
Hetho: Analyi 28-Hay-90	Total Number above De	tection Limit = 0	Waximum Detection	n Limit = 0.015	mg/
Hetho: Analy: 15-Hay-90 19-Hay-90	Total Number above De	tection Limit = 0	Waximum Detection	0.0150	mg/l
Hethol Analyi 5-Hay-90 9-Hay-90 2-Jun-90	Total Number above De	tection Limit = 0	Waximum Detection 0.0150 0.0150	0.0150 0.0150	#####
Hethol Analyi 15-Hay-90 19-Hay-90 12-Jun-90	Total Number above De	tection Limit = 0	0.0150 0.0150	0.0150 0.0150 0.0150 0.0150 0.0150	mg/l mg/l mg/l
Hethol Analyi 5-Hay-90 9-Hay-90 2-Jun-90	Total Number above De	tection Limit = 0	0.0150 0.0150 0.0150 0.0150 0.0150	0.0150 0.0150 0.0150 0.0150 0.0150	mg/l mg/l mg/l
Hetho: Anely: 18-Hay-90 19-Hay-90 12-Jun-90 18-Jun-90	Total Number above De	tection Limit = 0	0.0150 0.0150 0.0150 0.0150 Concentration Rai	0.0150 0.0150 0.0150 0.0150 0.0150	mg/1 mg/1 mg/1
Hetho: Analy: 18-Hay-90 9-Hay-90 2-Jun-90 8-Jun-90	Total Number above De	tection Limit = 0	0.0150 0.0150 0.0150 0.0150 Concentration Rai	0.0150 0.0150 0.0150 0.0150 0.0150 0.0150	ng/ ng/ ng/
Hetho: Analy: 25-Hay-90 12-Jun-90 18-Jun-90 Hetho:	Total Number above De	tection Limit = 0	0.0150 0.0150 0.0150 0.0150 Concentration Rai	0.0150 0.0150 0.0150 0.0150 0.0150 0.0150	ng/ ng/ ng/
Hetho: Analy: (5-Hay-90 (9-Hay-90 (2-Jun-90 (3-Jun-90 (4-Hay-90 (4-Hay-90 (4-Hay-90 (4-Hay-90 (4-Hay-90 (4-Hay-90 (4-Hay-90 (4-Hay-90	Total Number above De	tection Limit = 0	0.0150 0.0150 0.0150 0.0150 Concentration Rai	0.0150 0.0150 0.0150 0.0150 0.0150 0.0150	mg/1 mg/1 mg/1
Hetho: Analy: (5-Hay-90 (2-Jun-90 (3-Jun-90 (3-Jun-90 (4-Hay-90 (5-Hay-90 (5-Hay-90 (7-Hay-90 (7-Hay-90	Total Number above De	tection Limit = 0	0.0150 0.0150 0.0150 Concentration Rail Maximum Detection 0.0420 0.0420	0.0150 0.0150 0.0150 0.0150 0.0150 n Limit =	6:3/ 109/ 109/ 109/
Hethox Analys 18-Hay-90 19-Hay-90 12-Jun-90 8-Jun-90 Hethox Analys 8-Hay-90 9-Hay-90 2-Jun-90	Total Number above De	tection Limit = 0	0.0150 0.0150 0.0150 0.0150 Concentration Rai Maximum Detection	0.0150 0.0150 0.0150 0.0150 0.0150 0.0150	mg/ mg/ mg/ mg/i
#etho: Analy: 28-May-90 29-May-90 12-Jun-90 18-Jun-90 Metho: Analy: 18-May-90 19-May-90 12-Jun-90	Total Number above De	tection Limit = 0	0.0150 0.0150 0.0150 Concentration Rail Maximum Detection 0.0420 0.0420	0.0150 0.0150 0.0150 0.0150 0.0150 n Limit =	mg/ mg/ mg/ mg/ mg/

Table F2 (Continued)

ate Type of Blank	Detection Flag	Result	Detection Limit	Unit
Analysis for Lead by SU601	0			
Analyte: Lead continu	ed			
Total Number of 81	enks = 4	Concentration Range	0.042 - 0.042	
Total Number above	Detection Limit = 4	Maximum Detection L	imit =	

Table F2 (Continued)

Date	Type of Blank	Detection Flag	Result	Detection Limit	Units
Hethod	i: Chrome VI by SW7196			-	
Analyt	e: Chromium VI				
15-Hay-90	Preparation	NO	0.0050	0.0050	mg/L
16-Mey-90	Preparation	NO	0.0050	0.0050	mg/L
17-Hay-90	Preparation	жо	0.0050	0.0050	mg/L
18-Hay-90	Preparation	NO	0.0050	0.0050	ag/L
	Total Number of Blanks	3 = 4	Concentration R	ange XC	
	Total Number above De	tection Limit = 0	Maximum Detection	on Limit = 0.0050	

Table F2 (Continued)

Date	Type of Blank	Detection Flag	Result	Detection Limit	Units
	d: Conductivity (E120.1)				
Analy	te: Conductivity				
09-Jul-65	Method Blank	NO	1.0000	1.0000	umhos/d
6-Jul-90	Preparation	ND	1.0000	1.0000	umhos/d
4-sep-90	Preparation	NO	1.0000	1.0000	umhos/o
	Total Number of Slank	3	Concentration R	ange NC	
	Total Number above De	tection Limit = 0	Maximum Detection	on Limit = 1.0	
******	****************	*********************	*****************	**************	*******
Method	: Chioride by IC (E300.)))			
Analyt	e: Chioride				
9-Jul-90	Method Blank	NO	0.0200	0.0200	mg/Kg
9-Jul-90	Preparation	ND	5.0000	5.0000	mg/Kg
4-Sep-90	Preparation	NO	5.0000	5.0000	mg/Kg
	Total Number of Blanks	: = 3	Concentration Re	ange NC	
	Total Humber above De	ection Limit = 0	Maximum Detection	on Limit = 5.0	
*******	######################################	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		***************	*******
Method	: ICP Metals by SW6010				•
Analyt	e: Chromium				
1-Hay-90	Preparation	жо	0.3000	0.3000	mg/Kg
3-May-90	Preparation	NO	0.3000	0.3000	mg/Kg
1-#ay-90	Preparation	Ю	0.3000	0.3000	mg/Kg
5-Jun-90	Preparation	но	0.3000	0.3000	mg/Kg
1-Jun-90	Preparation	MO	0.3000	0.3000	mg/Kg
1-Jul-90	Preparation	КĐ	0.3000	0.3000	mg/Kg
2-Jul-90	Preparation	KO	0.3000	0.3000	mg/kg
7-Jul-90	Preparation	MO	0.3000	0.3000	mg/Kg
- Jul - 90	Preparation	NO	1.0000	1.0000	mg/Kg
	Preparation	жD	0.0100	0.0100	mg/Kg
5-Jul-90	, . cpair a c . co.				

Table F2 (Continued)

Dete	Type of Blank	Detection Flag	gesul t	Detection Limit	Unit
Analy:	sis for ICP Metals by SU	6010			
,	unelyte: Chromium contin	ued			
	Total Number of Blank	s = 11	Concentration Range		
	Total Number above De	tection Limit * U	Maximum Detection (.imit = 1.0	
Wethor	i: ICP Metals by SW6010				
	e: Iron				
1-Hay-90	Preparation	мр	0.7000	0.7000	mg/K
5-Hay-90	Preparation	CH	0.7000	0.7000	mg/X
-×ay-90	Preparation	<5x	2.4000		mg/K
- Jun-90	Preparation	ND	0.7000	0.7000	mg/K
-Jun-90	Preparation	NO	0.7000	0.7000	mg/K
-Jul-90	Preparation	NO	0.700C	0.7000	mg/I
-Jul-90	Preparation	NO.	0.7900	0.7000	mg/X
7-Jul-90	Preparation	KO .	0.7000	0.7000	mg/X
-Jul-90	Preparation	жo	4.0000	4.0000	mg/K
5-Jul-90	Preparation	KO	0.0400	0.0400	mg/K
5-Jul-90	Preparation	NO	0.7000	0.7000	mg/K
	Total Number of Blank	=	Concentration Range		
	Total Humber above De	tection Limit = 1	Haximum Detection t	imit = 4.0	
Hethoo	: ICP Metals by SW6010				
	e: Lead				
-Hay-90	Preparation	ю	4.2000	4.2000	mg/K
-Hay-90	Preparation	NO	4.2000	4.2000	mg/K
-May-90	Preparation	NO	4.2000	4.2000	mg/K
-jun-90	Preparation	NO	4.2000	4.2000	mg/K
- Jun-90	Preparation	NO	4.2000	4.2000	mg/K
- Jul - 90	Preparation	NO	4.2000	4.2000	mg/X
- Jul - 90	Preparation	NO	4.2000	4.2000	mg/K
'- Jul -90	Preparation	סא	4.2000	4.2000	mg/K
- Jul -90	Preparation	ND.	5.0000	5.0000	mg/K
- Jul - 90	Preparation	МО	0.0500	0.0500	mg/K

Date	Type of Blank	Detection Flag	Result	Detection Limit	t Units
Analy	rsis for ICP Metals by SW	o10			
	Analyte: Lead continued				
	Total Number of Blanks	= 11	Concentration R	ange NC	
	Total Number above Det	ection Limit = 0	Maximum Detecti	*	
Metho	d: ICP Metals by SW6010				
	te: Nickel				
1-Hay-90	Preparation	ND	1.5000	1.5000	mg/Kg
3-Hay-90	Preparation	С	1.5000	1.5000	mg/Kg
1-May-90	Preparation	NO	1.5000	1.5000	mg/Kg
5-jun-90	Preparation	NO	1.5000	1.5000	mg/Kg
1-Jun-90	Preparation	ОМ	1.5000	1.5000	mg/Kg
2-Jul-90	Preparation	NO	1.5000	1.5000	mg/Kg
7-Jul-90	Preparation	NO	1.5000	1.5000	mg/Kg
6-Jul-90	Preparation	жо	2.0000	2.0000	mg/Kg
5-Jul-90	Preparation	NO	0.0200	0.0200	mg/Kg
5-Jul-90	Preparation	NO	1.5000	1.5000	mg/Kg
	Total Number of Blanks		Concentration Ra	nge NC	
	Total Number above Dete	ection Limit = 0	Maximum Detection	n Limit = 2.0	
******	************	*********************	************	201222222222	******
Mashad	A Channe M. h. autica				
	: Chrome VI by SU7196 e: Chromium VI				
-Mey-90	Field Blank	ND	0.0200	0.0200	mg/Kg
-Hay-90	Field Black	ю	0.0090	0.0090	mg/Kg
-May-90	Field Blank	жD	0.0200	0.0200	mg/Kg
	Field Slank	ND	0.0050	******	-7/14

15-Mey-90 Field Blank	NO	0.0200	0.0200	mg/Kg
15-Hay-90 Field Black	NO	0.0090	0.0090	mg/Kg
15-May-90 Field Blank	NO	0.0200	0.0200	mg/Kg
15-May-90 Field Blank	MD	0.0050	0.0050	mg/Kg
15-May-90 Field Stank	KD	0.1900	0.1900	mg/Kg
16-May-90 Field Slank	ND.	0.0050	0.0050	mg/Kg
16-May-90 Field Blank		0.0100		mg/Kg
16-Hay-90 Field Blank	NO	0.0050	0.0050	mg/Kg
16-May-90 Field Blank	NO	0.0058	0.0050	mg/Kg
17-Mey-90 Field Blank	ЖD	0.0050	0.0050	mg/Kg
17-May-90 Field Blank	NO	0.0050	0.0050	mg/Kg
17-May-90 Field Blank	NO.	0.0050	0.0050	mg/Kg
17-Hay-90 Field Slank		0.0060		mg/Kg
18-May-90 Field Blank	MD	0.0050	0.0050	mg/Kg
**********************	**********************	****************	************	22223448:

Table F2 (Continued)

Date	Type of Slank	Detection Flag	Result	Detection Limit	Unit
Analy	sis for Chrome VI by SU7	196			
•	Analyte: Chromium VI cons	tinued			
18-May-90	Field Blank		0.0050		mg/K
5-May-90	Preparation	NO	0.0050	0.0050	mg/K
6-Hay-90	Preparation	NO	0.0050	0.0050	mg/K
7-Hay-90	Preparation	NO	0.0050	0.0050	mg/K
7-Hay-90	Preparation	NO	0.0050	0.0050	mq/Ko
7-Hay-90	Preparation	NO	0.0050	0.0050	mg/r
8-May-90	Preparation	OH	0.0050	0.0050	mq/K
8-May-90	Preparation	ND	0.0050	0.0050	mg/K
8-May-90		NO	0.0050	0.0050	mg/Kg
	Preparation	NO	0.2000	0.2000	mg/Kg
3-Aug-90	Preparation	NO	0.0800	0.0800	mg/Kg
	Total Number of Blanks	= 25	Concentration Range	0.0050 - 0.010	
	Total Number above Det	ection Limit * 3	Maximum Detection Li	mit = 0.20	
*******	************	******************	*****************	*************	
	: Sulfate by IC (E300.0)				
4-Sep-90	Preparation	ОМ	12.5000	12.\$000	mg/Kg
	Total Number of Blanks	* 1	Concentration Range	NC NC	
	Total Number above Dete	naina limia a O	Maximum Detection Lie		

Table F2 (Continued)

Date	Type of Blank	Detection Flag	Result	Detection Limit	Unit
Hethoo	: ICP Fetals by SU6010				
Anaiyı	e: Chromium				
19-5ep-90	Preparation	МО	0.0030	0.0030	mg/L
19-5ep-90	Preparation	ND	0.0030	0.0030	mg/L
25-Sep-90	Preparation	ND	0.0200	0.0200	mg/L
26-Sep-90	Preparation	<5X	0.0080		mg/L
	Total Number of Blank	s = 4	Concentration R	ange 0.0080 - 0.000	30
	Total Number above De	tection Limit * 1	Maximum Detection	on Limit = 0.020	
	: ICP Metals by SW6010				
Analyt	e: Iron				
9-Sep-90	Preparation	NO	0.0400	0.0400	mg/L
0-Sep-90	Preparation	KO	6.0400	0.0400	mg/L
6-Sep-90	Preparation	ND	0.0400		mg/L
	Total Number of Blank	s = 3	Concentration Ra		
	Total Number above De	tection Limit = 0	Maximum Detectio	on Limit * 0.040	
Method	: ICP Metals by SW6010				
	e: Lend				•
9-Sep-90	Preparation	MD	0.0500	0.0500	mg/L
0-Sep-90	Preparation	ко	0.0500	0.0500	mg/l
6-sep-90	Preparation	MO	0.0500		mg/L
	Total Number of Blanks	ı = 3	Concentration Ra	ange MC	
	Total Number above Det	tection Limit = 0	Maximum Detection	on Limit = 0.059	
	: ICP Metals by SW6010 - e: Wickel				
9-5en-90	Preparation	NO	0.0200	0.0200	mg/L
	Preparation	NO	0.0200	0.0200	mg/L
9 365 FU	Preparation	*D	0.0200		ma/L

Table F2 (Continued)

Date	Type of Blank	Detection Flag	Result	Detection Limi	t Unit
Analy	ais for ICP Metals by SW	6010			
	Analyte: Mickel continue	d			
	Total Number of Blank	s = 3	Concentration Rang	ge NC	
	Total Number above De	tection Limit = 0	Maximum Detection	Limit = 0.020	
*******	***********	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	*********************	*********	******
Method	: Chrome VI by \$97196				
	d: Chrome VI by \$87196 te: Chromium VI				
Analy		MO	0 0050	0.0050	mg/L
Analy	te: Chromium VI		0 0050		mg/L

Table F2 (Continued)

Date	Type of Blank	Detection Flag	Result	Detection Limit	Units
Metho	d: Arsenic by AA (E206.2))			
	te: Arsenta				
	Preparation	NO	0.0040	0.0040	mg/L
16-0ct-90	Preparation	NO	0.0040		mg/L
	Total Number of Blanks	-	Concentration Ra	nge NC	
	Total Number above Det	ection Limit = 0	Maximum Detectio	n Limit = 0.0040	
11888472 5	海水东水湖 使感觉 医电影 拉拉亚 医电阻 经加速 电电池 化二甲基苯甲基	**********************	*************	*************	*******
	: Conductivity (E120.1)				
Anelyt	e: Conductivity				
2-Jul-90	Hethod Blank	NO	1.0000	1.0000	umhos/s
2-Jul-90	Preparation	NO	1.0000	1.0000	umhos/ci
	Total Number of Blanks	* 2	Concentration Ran	rge NC	
********	Total Number above Deta	ection Limit * 0	Concentration Rar Maximum Detection	• -	
Analyt	Total Number above Dete	ection Limit * 0		• -	******
Analyt	Total Number above Dete	ection Limit * 0		• -	mg/L
Analyt	Total Number above Dete	######################################	Maximum Detection	• -	
Analyt	Total Number above Dete	######################################	Maximum Detection	se 0.00020 - 0.000	
Analyt	Total Number above Dete	######################################	Maximum Detection 0.0002 Concentration Ran Maximum Detection	se 0.00020 - 0.000	?0
Analyti 6-oct-90 Method:	Total Number above Dete	ection Limit * 0 4 (E245.1) 1 1 ction Limit * 1	Maximum Detection 0.0002 Concentration Ran Maximum Detection	ge 0.00020 - 0.0003	?0
Analyti 6-Oct-90 Method:	Total Number above Dete	ection Limit * 0 4 (E245.1) 1 1 ction Limit * 1	Maximum Detection 0.0002 Concentration Ran Maximum Detection	ge 0.00020 - 0.0003	?0
Analyte 5-Oct-90 Method: Analyte	Total Number above Dete	ection Limit * 0 4 (E245.1) 1 1 ction Limit * 1	Maximum Detection 0.0002 Concentration Ran Maximum Detection	ge 0.06020 - 0.000;	?0
Analyti 6-Oct-90 Method: Analyte -Aug-90 -Sep-90	Total Number above Dete	A (E245.1) I 1 ction Limit = 1 NO NO	0.0002 Concentration Ran Maximum Detection 0.0100 0.0100	ge 0.06020 - 0.000; Limit =	20
Analyte 5-Oct-90 Method: Analyte -Aug-90 -Sep-90	Total Number above Dete	ection Limit = 0 4 (E245.1) 2 1 ction Limit = 1	0.0002 Concentration Ran Maximum Detection	ge 0.00020 - 0.0000 Limit = 0.0100 0.0100	70 *******
Analyte 5-Oct-90 Method: Analyte -Aug-90 -Sep-90	Total Number above Dete	A (E245.1) I 1 ction Limit = 1 NO NO	0.0002 Concentration Ran Maximum Detection 0.0100 0.0100	ge 0.00020 - 0.0000 Limit = 0.0100 0.0100	70 ************************************

Table F2 (Continued)

Date	Type of Plank	Detection Flag	Result	Detection Limit	Unit
Anetys	is for ICP Metals by SU	6010			
,	inalyte: Barium continue	đ			
	Total Number of Blank	-	Concentration R	ange NC	
	Total Number above De	tection Limit = 0	Maximum Detecti	on Limit = 0.010	
⊭eth∞	:: ECP Metals by SW6010				
	et Cacmium				
7-Aug-90	Preparation	<5x	0.0093		mg/l
	Preparation	NO	0.0050	0.0050	mg/l
3-0=1-90	Preparation	NO	0.0050		mg/l
	Total Humber of 41.45	r 1 3	Concentration R	ange 0.0093 - 0.00	93
	Total Xumber agree Oc	tertion Limit = 1	Maximum Detecti	on Limit = 0.0050	
	a COP Metals by SWECTO er Chapping				
27-Aug-90	Preparation	40	0.0100	0.0100	mg/L
4 - 3 ep - 90	Preparation	NO	0.0030	0.0030	mg/l
	Preparation	⊀5 ∀	0.0040		mg/ (
	Preparation	±0	0.0030	0.0030	mg/L
	Preparation	NS	0.0030	0.0030	mg/L
8-0ct+90	Freperation	AŬ	0.0030	0.0030	Mg/1
	Total Number of Blank			enge 0.0040 - 0.00	40
	Total Number above De	tection limit # 1	Maximum Detectio	on Limit = 0,910	
Method	: ICP Metals by \$96010				
	e: Iron				
4 - \$ep - 90	Preparation	MQ	0,0400	5,0400	mg/L
3-0ct-90	Preparation	<5x	0.0460		mg/L
3-0ct-99	Preparation	<5x	0,0810		mg/L
	Preparation	=0	0.0400	0.0400	mg/L
A - OC E - A-1					

Table F2 (Continued)

Date	Type of Blank	Detection Flag	Result	Detection Limit	t Unit
,	sis for ICP Hetals by S				
,	Inelyte: Iron continued				
	Total Number of Blanks # 5 Total Number above Detection Limit # 2		Concentration Range 0.040 - 0.081 Maximum Detection Limit = 0.040		
					,
Hethod	: ICP Metals by 5=6010				
Analyt	te: Lead				
7-1,	Preparation	ко	0.0500	0.0500	mg/L
•	Precaration	ND	0.0500	0.0500	mg/L
	Preparation	ND	0.0500	0.0500	mg/L
	Preparation	ND	0.0500	0.0500	mg/L
	Preparation	ХD	0.0500	0.0500	mg/L
		-	0.0500	0.0500	mg/L
	Preparation	ND	0.0300	0.0304	-
	Preparation Total Number of Blance		Concentration #:		
		rs = 6	Concentration R		
	Tatal Number of Blan	rs = 6	Concentration R	ange NC	
8-0ct-90	Tatal Number of Blan	rs = 6	Concentration R	ange NC	
8-Oct-90	Total Number of Bland Total Number above 0	rs = 6	Concentration R	ange NC	
8-Oct-90 Hethoc Analyt	Total Number of Bland Total Number above 00 In ICP Metals by SW6010	rs = 6	Concentration R	ange NC	, mg/L
Hethod Analyt	Total Number of Blanc Total Number shove Do It: ICP Metals by 5W6010 Te: Nickel	cs = 6 etection limit = 0	Concentration & Maximum Detection	ange NC on Limit = 0.050	
Hethoc Analyt 4-seo-90 3-Oct-90	Total Number of Blance Total Number above 0: ICP Metals by SW6010 e: Nickel Preparation	cs = 6 etection Limit = 0	Concentration R Maximum Detection	ange NC on Limit = 0.050	mg/L
#ethoc Analyt 4-Sec-90 3-Oct-90	Total Number of Blance Total Number shove On it: ICP Metals by SW6010 ie: Nickel Preparation Preparation	cs = 6 etection Limit = 0 NO NO	Concentration R Maximum Detection 0.0200 0.0200	on Limit = 0.050 0.0200 0.0200	mg/L
Methoc Analyt 4-Seo-90 3-Oct-90 4-Oct-90	Total Number of Blance Total Number above 0: in ICP Metals by SW6010 in Nickel Preparation Preparation Preparation	cs = 6 etection Limit = 0 NO NO NO	Concentration R Maximum Detection 0.0200 0.0200 0.0200	0.0200 0.0200 0.0200	
Methoc Analyt 4-sec-90 3-oct-90 3-oct-90 4-oct-90	Total Number of Blance Total Number shove On it: ICP Metals by SW6010 et: Nickel Preparation Preparation Preparation Preparation Preparation	cs = 6 etection Limit = 0 NO NO NO NO NO NO NO	Concentration R. Maximum Detection R. 0.0200 0.0200 0.0200 0.0200 0.0200 Concentration R.	0.0200 0.0200 0.0200 0.0200 0.0200 0.0200	mg/L
Methoc Anelyt 4-Sec-90 3-Oct-90 3-Oct-90 4-Oct-90	Total Number of Blance Total Number above 0: I: ICP Metals by SW6010 I: Nickel Preparation Preparation Preparation Preparation Preparation Preparation	cs = 6 etection Limit = 0 NO NO NO NO NO NO NO	Concentration R. Maximum Detection R. 0.0200 0.0200 0.0200 0.0200 0.0200 Concentration R.	0.0200 0.0200 0.0200 0.0200 0.0200 0.0200 0.0200	mg/L mg/L mg/L
#ethoc Analyt 4-Seo-90 3-Oct-90 4-Oct-90 8-Oct-90	Total Number of Blanch Total Number above On	cs = 6 etection Limit = 0 NO NO NO NO NO NO NO	Concentration R. Maximum Detection R. 0.0200 0.0200 0.0200 0.0200 0.0200 Concentration R.	0.0200 0.0200 0.0200 0.0200 0.0200 0.0200	mg/L mg/L mg/L
#ethoc Analyt 4-Sec-90 3-Oct-90 4-Oct-90 #ethoc	Total Number of Blance Total Number shove 0: I: ICP Metals by SW6010 I: Nickel Preparation Preparation Preparation Preparation Preparation Total number of Blance	cs = 6 etection Limit = 0 NO NO NO NO NO NO NO	Concentration R. Maximum Detection R. 0.0200 0.0200 0.0200 0.0200 0.0200 Concentration R.	0.0200 0.0200 0.0200 0.0200 0.0200 0.0200	mg/L mg/L
Method Analyt 4-Sec-90 3-Oct-90 4-Oct-90 B-Oct-90 Method Analyt	Total Number of Blanch Total Number above 00 in ICP Metals by SU6010 in Nickel Preparation Preparation Preparation Preparation Preparation Preparation Total number of Blanch Total Number above 00 in ICP Metals by Su6010	cs = 6 etection Limit = 0 NO NO NO NO NO NO NO	Concentration R. Maximum Detection R. 0.0200 0.0200 0.0200 0.0200 0.0200 Concentration R.	0.0200 0.0200 0.0200 0.0200 0.0200 0.0200	mg/L mg/L
Method Analyt 6-Sec-90 3-Oct-90 6-Oct-90 6-Oct-90 Method Analyt	Total Number of Blanch Total Number shove On Total Number shove On the ICP Metals by SW6010 re: Nickel Preparation Preparation Preparation Preparation Total number of Blanch Total Number shove On the ICP Metals by SW6010 re: Silver	cs = 6 etection Limit = 0 MD MD MD MD MD MD MD MD MD M	Concentration R. Maximum Detection 0.0200 0.0200 0.0200 0.0200 0.0200 Concentration Re Maximum Detection	0.0200 0.0200 0.0200 0.0200 0.0200 0.0200	mg/L mg/L mg/L

Table F2 (Continued)

	Type of Blank	Detection Flag	Result	Detection Limit	Unit
Analys	is for ICP Metals by Sw	×010			
	nalyte: Silver continue	-d			
	Total Number of Blank		Concentration Ra	inge 0.013 - 0.013	5
		etection Limit = 1			
*********	· · · · · · · · · · · · · · · · · · ·	***************************************	1. 经收益的 医生物 化二甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基	· 建水水溶液 5 平 3 平 5 平 5 平 5 平 5 平 5 平 5 平 5 平 5 平	
	: Selenium by AA (E270.	2)			
Analyt	e: Selenium				
27-Aug-90	Preparation	NO	0.0050	0.0050	mg/L
6-0ct-90	Preparation	NO	0.0050		mg/L
	Total Number of Blank	s = 2	Concentration Ra		
	Total Number above Da	etection Limit = 0	Maximum Detection	n Liait = 0.0050	
Anelys	: Chrome VI by SW7196 e: Chromium VI			0.0300	
Anely1 06-Jul-90 06-Jul-90		NO NO NO	0.0200 0.0200 0.0200	0.0200 0.0200 0.0200	mg/L
Anely1 06-Jul-90 06-Jul-90	Preparation Preparation	MO NO	0.0200 0.0200 Concentration Re	0.0200 0.0200	mg/L
Anely1 06-Jul-90 06-Jul-90	e: Chromium VI Preparation Preparation Preparation	MO NO	0.0200	0.0200 0.0200	mg/L
Anelys 06-Jul-90 06-Jul-90 23-Aug-90	Preparation Preparation Preparation Preparation Total Number of Blank Total Number above De	MO NO	0.0200 0.0200 Concentration Ra Maximum Detection	0.0200 0.0200 onge NC on Limit * 0.020	mg/L
Anely1 06-Jul-90 06-Jul-90 23-Aug-90 Kethoo	Preparation Preparation Preparation Preparation Total Number of Blank Total Number above De	MO MO tection Limit = 0	0.0200 0.0200 Concentration Ra Maximum Detection	0.0200 0.0200 onge NC on Limit * 0.020	mg/L
Anely1 06-Jul-90 06-Jul-90 23-Aug-90 Kethoo	e: Chromium VI Preparation Preparation Total Number of Blank Total Number above De	MO MO tection Limit = 0	0.0200 0.0200 Concentration Ra Maximum Detection	0.0200 0.0200 onge NC on Limit * 0.020	mg/L
Anelys 06-Jul-90 06-Jul-90 23-Aug-90 Methoc	Preparation Preparation Preparation Preparation Total Number of Blank Total Number above De	MO MO tection Limit = 0	0.0200 0.0200 Concentration Ra Haximum Detection	0.0200 0.0200 m Limit = 0.020	mg/L mg/L mg/L
Analy1 26-Jul-90 25-Aug-90 23-Aug-90 Method Analy1	Preparation Preparation Preparation Preparation Total Number of Blane Total Number above De Sulfate by IC (E300.0 e: Sulfate	MO MO SET 3 Rection Limit = 0	0.0200 0.0200 Concentration Ra Haximum Detection	0,0200 0.0200 inge NC in Limit = 0.020	mg/L mg/L
Analy1 26-Jul-90 25-Aug-90 23-Aug-90 Method Analy1	Preparation Preparation Preparation Preparation Total Number of Blane Total Number above De Sulfate by IC (E300.0 e: Sulfate Method Blank	MO	0.0200 0.0200 Concentration Ra Haximum Detection	0.0200 0.0200 0.0200 In Limit = 0.020	mg/L mg/L
Analy1 06-Jul-90 06-Jul-90 23-Aug-90 Method Analy1	Preparation Preparation Preparation Preparation Total Number of Blank Total Number above De Sulfate by IC (E300.0 e: Sulfate Method Blank Preparation	MO MO 15 * 3 Prection Limit * 0 18 * 80 MO 18 * 2	0.0200 0.0200 Concentration Ra Haximum Detection	0.0200 0.0200 on Limit = 0.020 0.0500 12.0000	mg/L mg/L

Table F2 (Continued)

Date	Type of Blank	Detection Flag	Result	Detection Limit	Unit
Hetho	d: Arsenic by AA (E206.2)			
Anely	te: Arsenic				
20-sep-90	Preparation	NO	0.0040	0.0040	ng/X
·····	Total Number of Stanks	3 2 1	Concentration R	enge XC	
	Total Humbar above Det	tection Limit = 0	Maximum Detection	on Limit = 0.0640	
********	***************	***********************	**************	**************	****
	: Chloride by IC (E300.0 e: Chloride)			
8-Sep-90	Preparation	МО	5.0000	5.0000	mg/K
	Total Number of Blanks	= 1	Concentration Ra	nge NC	
	Total Number above Det	ection Limit = 0			
	: ICP Metala by Su6010	**********************	Maximum Detection	n Limit = 5.0	71111
Anelyte	: ICP Metala by SW6010	***************************************	MAXIMUM DETECTION		# # # #
Anelyti	: ICP Metals by SW6010 :: Chromium	<5x	0.4000	n Limit = 5.0	ng/K
Analyte)-Sep-90 i-Sep-90	: ICP Metals by SW6010 :: Chromium Preparation Preparation	**************************	***********************		-
Analyte - Sep-90 - Sep-90 - Sep-90	: ICP Metals by SW6010 :: Chromium Preparation Preparation Preparation	<5x	0.4000		mg/Kg
Analyte -Sep-90 -Sep-90 -Sep-90 -Sep-90	: ICP Metals by SW6010 :: Chromium Preparation Preparation Preparation Preparation Preparation	<5x NO	0.4000 0.0500		mg/Kg mg/Kg
Analyte -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Sep-90	Preparation	<5x NO <5x	0.4000 0.0500 0.4000		mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg
Analyte -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Sep-90	: ICP Metals by SW6010 :: Chromium Preparation Preparation Preparation Preparation Preparation	<5x NO <5x NO	0,4000 0,0500 0,4000 0,4000 0,3000		mg/Kg mg/Kg mg/Kg mg/Kg
Analyte -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Sep-90	: ICP Metals by Su6010 :: Chromium Preparation Preparation Preparation Preparation Preparation Preparation Total Number of Slanks	<5x NO <5x NO <5x NO	0,4000 0,0500 0,4000 0,3000 0,0080 0,3000	0.0800 .	mg/Kg mg/Kg mg/Kg mg/Kg
Analyte 0-Sep-90 5-Sep-90 5-Sep-90 8-Sep-90 8-Sep-90	Preparation	<5x NO <5x NO <5x NO	0,4000 0,0500 0,4000 0,3000 0,0080 0,3000	0.0800 . 0.3000 94 0.0080 - 0.40	mg/Kg mg/Kg mg/Kg
Anelyte 0-Sep-90 (-Sep-90 (-Sep-90 (-Sep-90 (-Sep-90 (-Oct -90	: ICP Metala by Su6010 r: Chromium Preparation Preparation Preparation Preparation Preparation Total Number of Slanks Total Number above Dete	<5x NO <5x NO <5x NO	0.4000 0.0500 0.4000 0.3000 0.0080 0.3000	0.0800 . 0.3000 94 0.0080 - 0.40	mg/Kg mg/Kg mg/Kg mg/Kg
Anelyte 0-Sep-90 (-Sep-90 (-Sep-90 (-Sep-90 (-Sep-90 -Oct -90	: ICP Metala by Su6010 :: Chromium Preparation Preparation Preparation Preparation Preparation Total Number of Slanks Total Number above Dete	<5x NO <5x NO <5x NO	0.4000 0.0500 0.4000 0.3000 0.0080 0.3000	0.0800 . 0.3000 94 0.0080 - 0.40	mg/Kg mg/Kg mg/Kg mg/Kg
Analyte -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Method: Analyte	Preparation Preparation Preparation Preparation Preparation Preparation Preparation Preparation Preparation Total Number of Slanks Total Number above Dete	<5x NO <5x NO <5x NO	0.4000 0.0500 0.4000 0.3000 0.0080 0.3000	0.0800 . 0.3000 9e 0.0080 - 0.40 Limit = 0.30	mg/Kg mg/Kg mg/Kg mg/Kg
Analyte -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Method: Analyte	: ICP Metala by Su6010 r: Chromium Preparation Preparation Preparation Preparation Preparation Total Number of Slanks Total Number above Dete	<5x NO <5x NO <5x NO <5x NO	0,4000 0,0500 0,4000 0,3000 0,0080 0,3000 Concentration Ram Maximum Detection	0.0800 . 0.3000 9e 0.0080 - 0.40 Limit = 0.30	mg/Kg mg/Kg mg/Kg mg/Kg
Analyte -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Sep-90 -Method: Analyte	Preparation Preparation Preparation Preparation Preparation Preparation Preparation Preparation Preparation Total Number of Slanks Total Number above Dete	<5x NO <5x NO <5x NO <5x NO * 6 **ction Limit = 3	0,4000 0,0500 0,4000 0,3000 0,0080 0,3000 Concentration Ran Maximum Detection	0.0800 . 0.3000 94 0.0080 - 0.40 Limit = 0.30	mg/Ki mg/Ki mg/Ki mg/Ki mg/Ki mg/Ki mg/Ki
Analyte 0-Sep-90 5-Sep-90 5-Sep-90 5-Sep-90 6-Oct-90 Method: Analyte -Sep-90 6-Oct-90 Foct-90	Preparation Preparation Preparation Preparation Preparation Preparation Preparation Preparation Preparation Total Number of Slanks Total Number above Dete	<5x NO <5x NO <5x NO <5x NO * 6 **ction Limit = 3	0,4000 0,0500 0,4000 0,3000 0,0080 0,3000 Concentration Ran Maximum Detection	0.0800 . 0.3000 9.4 0.0080 - 0.40 Limit = 0.30	mg/Kg mg/Kg mg/Kg mg/Kg

Table F2 (Concluded)

Date	Type of Blank	Detection Flag	Result	Detection Limit	Units
Anelys	sis for ICP Metals by SW	6010			
,	Inslyte: Iron continued				
	Total Number of Blank	s = 5	Concentration Ra	inge 0.060 - 8.9	
	Total Number above De	tection Limit = 2	Maximum Detection	on Limit = 4.0	
	n: ICP Metals by SW6010 cr Lead				
6-5 ep-9 0	Preparation	жō	5.0000	5.0000	mg/K
8-sep-90	Preparation	NO	5.0000		mg/K
3-∞t-90	Preparation	NO	5.0000	5.0000	mg/Kg
3-0ct-90	Preparation	NO	0.0500		mg/K
	Total Number of Blank	3 = 4	Concentration Ra	inge NC	
	Total Number above De	tection Limit = 0	Maximum Detection	on Limit = 5.0	
6-Sep-90	Preparation	жо	2.0000	2.0000	mg/Ki
8-Sep-90	Preparation	MO	2.0000		mg/Kg
1·0ct-90	Preparation	MO	0.0200		mg/Kg
3-0ct-90	Preparation	MC	2.0000	2.0000	mg/Kg
	Total Number of Blank	1 = 4	Concentration Ra	nge NC	
	Total Number above De	tection Limit = 0	Maximum Detectio	n Limit = 2.0	
********	******************	************************	**************	*************	22222
	: Salenium by AA (E270.)	2)			
Anelyt	e: Selenium				
0-Sep-90	Preparation	NO	0.0000	0.0000	mg/Kg
	Total Number of Blanks	s • 1	Concentration Ra	nge NC	
	Total Number above De	tection Limit * 0	Maximum Detectio	n Limit # 0.00000	

Table F3

Summary of Quality Control Check Sample (QCCS)

Results, Frontier Hard Chrome

. Date	Type of Blank	Detection Flag	Result	Detection Limit	Units
Hetho	d: Chrome VI by SW7196				
Analy	te: Chromium VI				
20-S ep-9 0	Preparation	МО	0.0050	0.0050	mg/Kg
	Total Number of Blank	s = 1	Concentration Ra	inge NC	
	Total Number above De	tection Limit = 0	Maximum Detection	n Limit = 0.0050	
********	*****************	***************************************	**************	****************	32588
Hethod	: Sulfate by IC (E300.0))			
Analyt	e: Sulfate				
28-Sep-90	Preparation	Ю	12.5000	12.5000	mg/Kg
	Total Number of Blanks	1	Concentration Ra	nge NC	
		ection Liait # 0	Maximum Detection		

Table F3 (Continued)

SUMMARY OF GCCS RESULTS FOR MATRIX = MW EP LEACHATE

我这样就不是在我这个点,我们就是我们的是不是不是不是不是不是不是不是不是不是。			**********
	Number of	Hean X	
Parameter	Samples	Recovery	CV (X)
ICP Metals by SW6010			
Calibration Control Sample			
Chromium	5	98.9	1.3
Iron	7	98.2	1.3
Lead	7	97.5	1.0
Nickel	7	97.9	1.3

Table F3 (Continued)

SLIMMARY OF GCCS RESULTS FOR MATRIX = Solid

	Number		
	of	Hean X	
Parameter	Samples	Recovery	CV (%)
Arsenic by AA (E206.2)			
Calibration Control Sample			
Arsenic	5	96.8	6.0
Conductivity (E120.1)			
Calibration Control Sample			
COHO	5	98.5	2.0
Conductivity	5	100.0	.4
Chloride by IC (E300.0)			
Calibration Control Sample			
Chloride	7	98.3	1.0
ercury by Cold Vapor AA (E245.1)			
Calibration Control Sample			
Mercury	3	98.3	1.5
CP Metals by SUC010			
Calibration Control Sample			
Berium	4	97.0	1.6
Cadmium	4	95.9	2.4
Chromium -	79	101.6	3.3
Iron	77	100.9	3.3
Lead	80	101,7	3.3
Nickel	72	101.3	3.4
Silver	4	97.5	1.1
Laboratory Control Sample			
Chromium	2	96.0	4.4
Iron	2	104.8	3.8
Lead	2	94.7	4.9
Mickel	2	90.9	14.2
Lenium by AA (E270.2)			
Calibration Control Sample			
Setenium	5	96.5	3.1
rome VI			
Calibration Control Sample			
Chromium VI	4	98.9	1 1
Caromium VI	4	98.9	1.3

Table F3 (Continued)

SUMMARY OF OCCS RESULTS FOR MATRIX = Solid

· 在 · · · · · · · · · · · · · · · · · ·	RERECTED SERVICE SERVI	****************	***************
	Number		
	af	Hean %	
Persneter	Samples	Recovery	CV (%)
Chrone VI			
Laboratory Control Sample			
Chromium VI	27	98.0	3.7
Sulface by IC (E300.0)			
Calibration Control Sample			
Sulfate -	5	97.7	1.2

Table F3 (Concluded)

SUMMARY OF OCCS RESULTS FOR MATRIX = TREATED

	Number		
	of .	¥ean %	
Parameter	Samples	Recovery	CV (%)
Arsenic by AA (E206.2)			
Calibration Control Sumple			
Arsenic	5	99.4	8.5
Laboratory Control Sample			
Arsenic	1	114.4	
Conductivity (E120.1)			
Calibration Control Sample			
Conductivity	12	100.2	.9
hloride by IC (E300.0)			
Calibration Control Sample			
Chloride	14	98.0	2.5
ercury by Cold Vapor AA (E245.1)			
Calibration Control Sample			
Mercury	4	98.1	2.6
CP Netals by SU6010			
Calibration Control Sample			
Barium	9	99.5	1.4
Cadalua	9	95.6	3.5
Chronium	44	100.7	2.1
Chronium VI	1	102.0	
Iron	45	98.7	2.0
Lead Nickel	42	101.8	5.2
Silver	39	101.8	4.9
Laboratory Control Sample	9	97.8	2.5
Barium			
Cacheius	1	102.0	
Chromium	1	102.0	
tron	8	94.6	6.5
tron Lead	6	91.8	10.3
Nickel	7	96.4	7.2
M)CAC1	7	90.7	9.9

pH by SV9045

Table F4

Detailed Listing of Quality Control Check Sample (QCCS)

Results, Frontier Hard Chrome

SUPPLARY OF GCCS RESULTS FOR MATRIX = TREATED

	***************	************	************
	Number		
	of	Hean X	
Parameter	Samples	Recovery	CV (%)
on by 549045			
Calibration Control Sample			
PH	3	100.9	.5
Selenium by AA (E270.2)			
Calibration Control Sample			
Selenium	5	96.7	3.8
Laboratory Control Sample			
Selenium	1	83.6	
hrone VI			
Calibration Control Sample			
Chrowium VI	31	102.1	2.1
ulfate by IC (E300,0)			
Calibration Control Sample			
Sulfate	15	97.0	2.4

Table F4 (Continued)

Cate		True Value	Det Flag	Measured Value	Recover
Method: Arsenic	by AA (E206.2)				
Matrix: Solid					
Analyte: Arsenic					
Type of Control	Sample: Calibration Control	Sample.			
27-Aug-90		0.050 mg/L		0.052 mg/L	104.00
27-Aug-90		0.050 mg/L		0.049 mg/L	98.00
06-Sep-90		0.050 mg/L		0.046 mg/L	92.00
06-Sep-90		0.050 mg/L		0.050 mg/L	100.00
06-Sep-90		0.050 mg/L		0.045 mg/L	90.00
	Number of Samples = 5	Hean % Recovery :	96.8	CV (%) =	6.0
Metrix: TREATED	**********************	Mean % Recovery :	96.8	CV (%) =	6.0
Matrix: TREATED Inalyte: Arsenic	**********************	*****************	96.8	CV (%) =	6.0
Natrix: TREATED Inalyte: Arsenic Type of Control S	y M (E206.2)	emple.	96.8	************	21112111
Natrix: TREATED Inalyte: Arsenic Type of Control S 6-Sep-90	y M (E206.2)	*****************	96.8	0.050 mg/L	100.00
Matrix: TREATED Inalyte: Arsenic Type of Control S 6-Sep-90 6-Sep-90	y M (E206.2)	ample.	96.8	************	21112111
Natrix: TREATED nalyte: Arsenic ype of Control S 6-Sep-90 6-Sep-90 6-Sep-90 6-Sep-90 6-Oct-90	y M (E206.2)	ample. 0.050 mg/L 0.050 ag/L	96.8	0.050 mg/L 0.046 mg/L	100.00 92.00
Method: Arsenic b Metrix: TREATED Analyte: Arsenic Type of Control S Med-Sep-90 6-Sep-90 6-Sep-90 6-Oct-90 6-Oct-90	y M (E206.2)	ample. 0.050 mg/L 0.050 ag/L 0.050 mg/L	96.8	0.050 mg/L 0.046 mg/L 0.045 mg/L	100.00 92.00 90.00
Natrix: TREATED nalyte: Arsenic ype of Control S 6-Sep-90 6-Sep-90 6-Sep-90 6-Oct-90 6-Oct-90	y M (E206.2)	0.050 mg/L 0.050 mg/L 0.050 mg/L 0.050 mg/L 0.050 mg/L	96.8	0.050 mg/L 0.046 mg/L 0.045 mg/L 0.053 mg/L	100.00 92.00 90.00 105.00
Natrix: TREATED nalyte: Arsenic ype of Control S 6-Sep-90 6-Sep-90 6-Sep-90 6-Oct-90 6-Oct-90	my AA (E206.2) ample: Calibration Control S	0.050 mg/L 0.050 mg/L 0.050 mg/L 0.050 mg/L 0.050 mg/L	96.8	0.050 mg/L 0.046 mg/L 0.045 mg/L 0.053 mg/L	100.00 92.00 90.00 105.00

Table F4 (Continued)

*************************	***************		<*************************************	
Date	True Value	Det Flag	Measured Value	X Recovery
Method: Conductivity (E120.1)				
Matrix: Solid				
Inelyte: COMD				
ype of Control Sample: Calibration	Control Sample.			
2-Jul-90	1403.0	umhos/cm	1384,000 mhos	98.65
2-Jul-90	1403.0	umnos/cm	1409,000 mhos	100.43
I Jul-90	1403.0	umnos/cm	1405,000 mnos	100.14
?6-Jul-90	1403.0	umnos/cm	1345.000 mnos	95.87
6-Jul-90	1403.0	umnos/cm	1365.000 mhos	97.29
Number of Sample	s * 5 Hean % Reco	overy = 98.5	CA (X) =	.0
Method: Conductivity (E120.1)				
Matrix: Solid				
nalyte: Conductivity				
, ,				
ype of Control Sample: Calibration				
ype of Control Sample: Calibration 4-Sep-90	1400.0	umnos/cm	1395,000 umhos/cm	
Type of Control Sample: Calibration 14-Sep-90 14-Sep-90	1400.0 1400.0	umnos/cm	1409,000 umnos/cm	100.64
Type of Control Sample: Calibration M-Sep-90 M-Sep-90 M-Sep-90	1400.0 1400.0 1400.0	umhos/cm umhos/cm	1409,000 umnos/cm 1398,000 umnos/cm	100.64 99.86
ype of Control Sample: Calibration 4-Sep-90 4-Sep-90 4-Sep-90 5-Sep-90	1400.0 1400.0 1400.0 1400.0	umhos/cm umhos/cm umhos/cm	1409.000 umnos/cm 1398.000 umnos/cm 1399.000 umnos/cm	100.64 99.86 99.93
ype of Control Sample: Calibration 4-Sep-90 4-Sep-90 4-Sep-90 5-Sep-90	1400.0 1400.0 1400.0 1400.0	umhos/cm umhos/cm	1409,000 umnos/cm 1398,000 umnos/cm	100.64 99.86 99.93
ype of Control Sample: Calibration 4-Sep-90 4-Sep-90 4-Sep-90 5-Sep-90	1400.0 1400.0 1400.0 1400.0 1400.0	umhos/cm umhos/cm umhos/cm	1409.000 umnos/cm 1398.000 umnos/cm 1399.000 umnos/cm	100.64 99.86 99.93
Type of Control Sample: Calibration W-Sep-90 W-Sep-90 W-Sep-90 IS-Sep-90	1400.0 1400.0 1400.0 1400.0 1400.0	umhos/cm umhos/cm umhos/cm umhos/cm	1409,000 umnos/cm 1398,000 umnos/cm 1399,000 umnos/cm 1397,000 umnos/cm	100.64 99.86 99.93 99.79
Type of Control Sample: Calibration 4-Sep-90 4-Sep-90 5-Sep-90 5-Sep-90	1400.0 1400.0 1400.0 1400.0 1400.0	umhos/cm umhos/cm umhos/cm umhos/cm	1409,000 umnos/cm 1398,000 umnos/cm 1399,000 umnos/cm 1397,000 umnos/cm	100.64 99.86 99.93 99.79
ype of Control Sample: Calibration 4-Sep-90 4-Sep-90 4-Sep-90 5-Sep-90 Mumber of Sample:	1400.0 1400.0 1400.0 1400.0 1400.0	umhos/cm umhos/cm umhos/cm umhos/cm	1409,000 umnos/cm 1398,000 umnos/cm 1399,000 umnos/cm 1397,000 umnos/cm	100.64 99.86 99.93 99.79
ype of Control Sample: Calibration 4-Sep-90 4-Sep-90 5-Sep-90 Number of Sample: ethod: Conductivity (E120.1)	1400.0 1400.0 1400.0 1400.0 1400.0	umhos/cm umhos/cm umhos/cm umhos/cm	1409,000 umnos/cm 1398,000 umnos/cm 1399,000 umnos/cm 1397,000 umnos/cm	100.64 99.86 99.93 99.79
ype of Control Sample: Calibration 4-Sep-90 4-Sep-90 5-Sep-90 Number of Sample: ethod: Conductivity (E120.1) atrix: TREATED malyte: Conductivity	1400.0 1400.0 1400.0 1400.0 1400.0	umhos/cm umhos/cm umhos/cm umhos/cm	1409,000 umnos/cm 1398,000 umnos/cm 1399,000 umnos/cm 1397,000 umnos/cm	100.64 99.86 99.93 99.79
ype of Control Sample: Calibration 4-Sep-90 4-Sep-90 5-Sep-90 Number of Sample: ethod: Conductivity (E120.1) atrix: TREATED malyte: Conductivity ypc of Control Sample: Calibration 6-Sep-90	1400.0 1400.0 1400.0 1400.0 1400.0 s = 5 Mean X Reco	umhos/cm umhos/cm umhos/cm umhos/cm	1409,000 umnos/cm 1398,000 umnos/cm 1399,000 umnos/cm 1397,000 umnos/cm	100.64 99.86 99.93 96.79
ype of Control Sample: Calibration 4-Sep-90 4-Sep-90 5-Sep-90 Number of Sample: ethod: Conductivity (E120.1) atrix: TREATED malyte: Conductivity rpc of Control Sample: Calibration i-Sep-90 i-Sep-90	1400.0 1400.0 1400.0 1400.0 1400.0 S = 5 Mean X Reco	umnos/cm umnos/cm umnos/cm umnos/cm	1409.000 umos/cm 1298.000 umos/cm 1399.000 umos/cm 1397.000 umos/cm CV (X) =	100.64 99.86 99.93 96.79 .0
ype of Control Sample: Calibration 4-Sep-90 4-Sep-90 5-Sep-90 Number of Sample: ethod: Conductivity (E120.1) atrix: TREATED malyte: Conductivity ypc of Control Sample: Calibration 4-Sep-90 4-Sep-90 4-Sep-90 4-Sep-90	1400.0 1400.0 1400.0 1400.0 1400.0 S = 5 Mean X Reco	umnos/cm umnos/cm umnos/cm umnos/cm umnos/cm umnos/cm umnos/cm	1409.000 umos/cm 1397.000 umos/cm 1397.000 umos/cm CV (X) = 1409.000 umos/cm 1409.000 umos/cm 1409.000 umos/cm	100.64 99.83 99.93 96.79 .0
ype of Control Sample: Calibration 4-Sep-90 4-Sep-90 5-Sep-90 Number of Sample: ethod: Conductivity (E120.1) atrix: TREATED nelyte: Conductivity ypc of Control Sample: Calibration 4-Sep-90 4-Sep-90 4-Sep-90 4-Sep-90	1400.0 1400.0 1400.0 1400.0 1400.0 s = 5 Mean % Reco	umnos/cm umnos/cm umnos/cm umnos/cm umnos/cm umnos/cm umnos/cm umnos/cm	1409.000 umnos/cm 1399.000 umnos/cm 1397.000 umnos/cm CV (X) = CV (X) = 1409.000 umnos/cm 1409.000 umnos/cm 1398.000 umnos/cm 1398.000 umnos/cm	100.64 99.93 99.93 90.79 .0
ype of Control Sample: Calibration 4-Sep-90 4-Sep-90 5-Sep-90 Number of Sample: ethod: Conductivity (E120.1) atrix: TREATED nalyte: Conductivity ypc of Control Sample: Calibration 4-Sep-90 4-Sep-90 4-Sep-90	1400.0 1400.0 1400.0 1400.0 1400.0 s = 5 Mean % Reco	umnos/cm umnos/cm umnos/cm umnos/cm umnos/cm umnos/cm umnos/cm	1409.000 umos/cm 1397.000 umos/cm 1397.000 umos/cm CV (X) = 1409.000 umos/cm 1409.000 umos/cm 1409.000 umos/cm	100.64 99.93 99.93 90.79 .0

Table F4 (Continued)

	True Det	Heasu red	x
Date	Value flo	g Value	Recovery
Method: Chloride by IC (E300.0)			
Matrix: TREATED			
Inalyte: Chloride			
Type of Control Sample: Calibration Control	Sample.		
14-Sep-90	8.000 mg/L	7.841 mg/L	98.01
14-Sep-90	8.000 mg/L	7.890 mg/L	98.63
14-Sep-90	8.000 mg/L	7.840 mg/L	98.00
14-Sep-90	8,000 mg/L	8.010 mg/L	100.13
14-sep-90	8.000 mg/L	7.890 mg/L	98.63
14-Sep-90	8.300 mg/L	7.841 mg/L	98.01
14-Sep-90	8.000 mg/L	7.890 mg/L	98.63
14-Sep-93	8.000 mg/L	8.010 mg/L	100.13
28-Sep-90	8.000 mg/L	8.210 mg/L	102.63
28-Sep-90	8.000 mg/L	7.940 mg/L	99.25
8-Sep-90	8.000 mg/L	7.750 mg/L	96.88
3-0ct-90	8.000 mg/L	7.543 mg/l	94.29
33-0ct-90	8.000 mg/L	7.581 mg/l	94.76
35-0ct-90	8.000 mg/L	7.516 mg/l	93.95
3-021-90	8.000 mg/t	7.510 Mg/ C	73.73
Number of Samples = 14	Mean % Recovery = 98.0	CV (%) =	2.5
***********************************			*********
			•
lethod: Mercury by Cold Vapor AA (E245.1)			
letrix: Salid			
helyte: Mercury			
ype of Control Sample: Calibration Control	Cample		
ype of control sample: calloration control	Jan Ster		
		0.004 mg/1	100.00
7-Aug-90	0,0040 mg/L	0.004 mg/L 0.004 mg/L	100.00
7-Aug-90 7-Aug-90	0.0040 mg/L 0.0040 mg/L	0.004 mg/L	97.50
7-Aug-90	0,0040 mg/L	•	
7-Aug-90 7-Aug-90	0.0040 mg/L 0.0040 mg/L	0.004 mg/L	97.50
7-Aug-90 7-Aug-90 4-Sep-90 Number of Samples = 3	0.0040 mg/L 0.0040 mg/L 0.0040 mg/L	0.004 mg/L 0.004 mg/L CV (%) x	97.50 97.50
7-Aug-90 7-Aug-90 4-Sep-90 Number of Samples = 3	0.0040 mg/L 0.0040 mg/L 0.0040 mg/L Hean X Recovery = 98.3	0.004 mg/L 0.004 mg/L CV (%) x	97.50 97.50
7-Aug-90 7-Aug-90 4-Sep-90 Number of Samples = 3	0.0040 mg/L 0.0040 mg/L 0.0040 mg/L Hean X Recovery = 98.3	0.004 mg/L 0.004 mg/L CV (%) x	97.50 97.50
7-Aug-90 7-Aug-90 4-Sep-90 Number of Samples = 3	0.0040 mg/L 0.0040 mg/L 0.0040 mg/L Hean X Recovery = 98.3	0.004 mg/L 0.004 mg/L CV (%) x	97.50 97.50

Table F4 (Continued)

Date		True	et Measured	×.
		Value i	lag Value	Recovery
lethod: Chloride by	y (C (E300.0)			
Matrix: TREATED				
nelyte: Chloride				
ype of Control San	mple: Calibration Control S	ample.		
4-Sep-90		8.000 mg/L	7.841 mg/L	98.01
14-Sep-90		8.000 mg/L	7.890 mg/L	98.43
4-Sep-90		8.000 mg/L	7.840 mg/L	98.00
4-Sep-90		8.000 mg/L	8.010 mg/L	100.13
4-Sep-90		8,000 mg/L	7.890 mg/L	98,63
14-Sep-90		8.000 mg/L	7.841 mg/L	98.01
4-Sep-90		8.000 mg/L	7.890 mg/L	98.63
4-Sep-90		8.000 mg/L	8.010 mg/L	100.13
8-Sep-90		8.000 mg/L	8.210 mg/L	102.63
8-Sep-90		8.000 mg/L	7.940 mg/L	99,25
8-Sep-90		8.00 \ mg/L	7.750 mg/L	96,83
3-0ct-90		8.000 mg/L	7.543 mg/l	94.29
3-0ct-90		8.000 mg/L	7.581 mg/l	94.76
3-0ct-90		8.000 mg/L	7.516 mg/l	93. 95
	Number of Samples = 14	Mean % Recovery = 98	3.0 CV (X) =	2.5
Method: Mercury by Matrix: Solid	Cold Vapor AA (EZ45.1)	***************************************	***************	**********
Method: Mercumy by Matrix: Solid Unalyte: Mercumy			*****************	
Method: Mercumy by Matrix: Solid Unalyte: Mercumy	Cold Vapor AA (EZ45.1)	ample.		
ethod: Mercury by Matrix: Solid nalyte: Mercury ype of Control Sam	Cold Vapor AA (EZ45.1)	ample. 0.0040 mg/L	0.004 mg/L	100.00
ethod: Mercury by atrix: Solid nalyte: Mercury ype of Control Sam 7-Aug-90 7-Aug-90	Cold Vapor AA (EZ45.1)	ample. 0.0040 mg/L 0.0040 mg/L	0.004 mg/L 0.004 mg/L	100.00 97.50
ethod: Mercury by mtrix: Solid nalyte: Mercury ype of Control Sam 7-Aug-90	Cold Vapor AA (EZ45.1)	ample. 0.0040 mg/L	0.004 mg/L	100.00

Table F4 (Continued)

		True	Det Measured	ı	
Date			Flag Value	Recovery	
Hethod: Hercury	by Cold Vapor AA (E245.1)				
Matrix: TREATED					
Anelyte: Hercur					
,	,				
Type of Control	Sample: Calibration Control	Sample.			
34-Sep-90		0.0040 mg/L	0.004 mg/L	95.00	
04-Sep-90		0.0040 mg/L	0.004 mg/L	97.50	
16-0ct-90		0.0040 mg/L	0.004 mg/l	99.00	
6-0ct-90		0.0040 mg/L	0.004 mg/l	101.00	
	Number of Samples = 4	Hean % Recovery = 98	3.1 CV (%) =	2.6	
推成游戏员事者有意义工程性	*********************	*************	************	*********	
lethod: ICP Heti	als by SW6010				
latrix: MV EP LE					
nelyte: Chromic					
ype of Control	Sample: Calibration Control S	ample.			
	Sample: Calibration Control S	ample. 5 000 mg/L	4.980 mg/t	99,60	
8-Jun-90	Sample: Calibration Control S		4.980 mg/L 5.000 mg/L	99.60 100.00	
8-Jun-90 8-Jun-90	Sample: Calibration Control S	5 000 mg/L			
8-Jun-90 8-Jun-90 8-Jun-90	Sample: Calibration Control S	5 000 mg/L 5.000 mg/L	5.000 mg/L	100.00	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90	Sample: Calibration Control S	5 000 mg/L 5.000 mg/L 5.000 mg/L	5.000 mg/L 4.890 mg/L	100.00 97.80	
Type of Control 18-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90	Sample: Calibration Control S Humber of Samples = 5	5 000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L	100.00 97.80 97.20	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90	Number of Samples = 5	5 000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L	100.00 97.80 97.20 99.80	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90	Number of Samples = 5	5 000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L	100.00 97.80 97.20 99.80	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90	Number of Samples = 5	5 000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L	100.00 97.80 97.20 99.80	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 ethod: ICP Heta etrix: MV EP LE Malvte: Iron	Number of Samples = 5	5 000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 6.000 mg/L	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L	100.00 97.80 97.20 99.80	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 ethod: ICP Meta strix: MW EP LE maivte: Iron upe of Control:	Number of Samples = 5 is by SW6010 ACMATE	5 000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L Meen % Recovery = 98.	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L	100.00 97.80 97.20 99.80	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 sthod: ICP Heta strix: MW EP LE Malyte: Iron spe of Control:	Number of Samples = 5 is by SW6010 ACMATE	5 000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 6.000 mg/L Meen % Recovery = 98.	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L 9 CV (X) =	100.00 97.80 97.20 99.80	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 9-Jun-90 9-Jun-90 9-Jun-90	Number of Samples = 5 is by SW6010 ACMATE	5 000 mg/L 5.000 mg/L	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L 9 CV (X) = 4.880 mg/L 4.840 mg/L	97.60 96.80	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 ethod: [CP Heta etrix: MW EP LE maivre: Iron pe of Control: -Jun-90 -Jun-90 -Jun-90	Number of Samples = 5 is by SW6010 ACMATE	5.000 mg/L	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L 9 CV (X) = 4.880 mg/L 4.840 mg/L 4.980 mg/L	97.60 96.80 97.60 99.80	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 ethod: [CP Meta etrix: MW EP LE malivte: Iron epe of Control: -Jun-90 -Jun-90 -Jun-90	Number of Samples = 5 is by SW6010 ACMATE	5.000 mg/L	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L .9 CV (X) = 4.880 mg/L 4.840 mg/L 4.980 mg/L 4.980 mg/L	97.60 96.80 97.60 97.60 97.60 96.80 97.60	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 9-Jun-90 9-Jun-90 9-Jun-90 9-Jun-90 9-Jun-90	Number of Samples = 5 is by SW6010 ACMATE	5.000 mg/L	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L 7.9 CV (X) = 4.880 mg/L 4.840 mg/L 4.980 mg/L 4.960 mg/L 4.960 mg/L	97.60 97.60 97.60 97.60 96.80 99.60 99.60 99.20	
8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 8-Jun-90 ethod: ICP Heta atrix: MW EP LE	Number of Samples = 5 is by SW6010 ACMATE	5.000 mg/L	5.000 mg/L 4.890 mg/L 4.860 mg/L 4.990 mg/L .9 CV (X) = 4.880 mg/L 4.840 mg/L 4.980 mg/L 4.980 mg/L	97.60 96.80 97.60 97.60 97.60 96.80 97.60	

Table F4 (Continued)

Date	True Value	Det Flag	Heasured Value	Recovery
Method: ICP Metals by \$W6010				
Matrix: MW EP LEACHATE				
Analyte: Iron				
Type of Control Sample: Calibrati	ion Control Sample, continue	đ		
Number of Samp	ples ≠ 7 Hean % Reco	very = 98.2	CV (%) *	1.3
Method: ICP Metals by \$96010				
Matrix: My EP LEACHATE				
Analyte: Lead				
Type of Control Sample: Calibrati	ion Control Sample.			
18-Jun-90	5.000	ang/L	4.830 mg/L	96.60
18-Jun-90	5.000	mg/L	4.890 mg/L	97.80
18-Jun-90	5.000	mg/L	4.810 mg/L	95,20
18-Jun-90	5.000	mg/L	4.860 mg/L	97.23
18-Jun-90	5.000	mg/L	4.950 mg/L	99.00
18-Jun-90	5.000	mg/L	4.910 mg/L	98.20
18-Jun-90	5.000	mg/L	4.880 mg/L	97.60
Number of Samp	oles = 7 Hean % Reco	very = 97.5	CV (%) =	1.0
Method: ICP Metals by SU6010				
Matrix: MY EP LEACHATE				
Acelyte: Mickel				
Type of Control Sample: Calibrati	on Control Sample.			
18-Jun-90	5.000	mg/L	4.830 mg/L	96.60
18-Jun-90	5.000	mg/L	4.890 mg/L	97,80
18-Jun-90	5.000	mg/L	4.780 mg/L	95.60
18-Jun-90	5.000	mg/L	4.960 mg/L	99.20
18-Jun-90	5.000	•	4,940 mg/L	98.80
18-Jun-90	5.000	•	4.920 mg/L	98,40
8-Jun-90	5.000	≈g/L	4.930 mg/L	95.60
10-3 u 1-70				

Table F4 (Continued)

	Irue	Det	Measured	ı
Date	Value	Flag	Value	Recovery
Method: ICP Metals by \$W6010				
Matrix: Solid				
Analyte: Barium				
Type of Control Sample: Calibration Control S	Sample.			
27-Aug-90	5.000 mg/L		4.790 mg/L	95.80
27-Aug-90	5.000 mg/L		4.310 mg/L	96.20
27-Aug-90	5.000 mg/L		4.830 mg/L	96.60
27-Aug-90	10.0 mg/L		9.930 mg/L	99.30
. Number of Samples = 4	Hean % Recovery =	97.0	CV (%) *	1.6
Method: ICP Metals by SW6010				
Metrix: Solid				
Analyte: Cadmium				
Type of Control Sample: Calibration Control S	Sample.			
27-Aug-90	5.000 mg/L		4.740 mg/L	94.80
			9.940 mg/L	99.40
27-Aug-90	10.0 mg/L			94.40
-	5.000 mg/L		4.720 mg/L	
27-Aug-90			4.720 mg/L 4.750 mg/L	95.00
27-Aug-90 27-Aug-90 27-Aug-90 Number of Samples = 4	5.000 mg/L	95.9		
27-Aug-90 27-Aug-90 Number of Samples = 4	5,000 mg/L 5,000 mg/L	95.9	4.750 mg/L	95.00
27-Aug-90 27-Aug-90	5,000 mg/L 5,000 mg/L	95.9	4.750 mg/L	95.00
27-Aug-90 27-Aug-90 Number of Samples = 4 Method: ICP Metals by SW6010	5,000 mg/L 5,000 mg/L	95.9	4.750 mg/L	95.00
27-Aug-90 27-Aug-90 Number of Samples = 4 Method: ICP Metals by SW6010 Matrix: Solid	\$.000 mg/L \$.000 mg/L Mean % Recovery =	95.9	4.750 mg/L	95.00
27-Aug-90 27-Aug-90 Number of Samples = 4 Method: ICP Metals by \$W6010 Matrix: Solid Analyte: Chromium Type of Control Sample: Calibration Control S	\$.000 mg/L \$.000 mg/L Mean % Recovery =	95.9	4.750 mg/L	95.00
27-Aug-90 27-Aug-90 Number of Samples # 4 Method: ICP Metals by \$W6010 Matrix: Solid Analyte: Chromium Type of Control Sample: Calibration Control S	\$.000 mg/L \$.000 mg/L Mean X Recovery =	95.9	4.750 mg/L	95.00 2.4 102.60 102.60
27-Aug-90 27-Aug-90 Number of Samples # 4 Method: ICP Metals by \$W6010 Matrix: Solid Malyte: Chromium Mype of Control Sample: Calibration Control S May-90 May-90 May-90	\$.000 mg/L \$.000 mg/L Mean X Recovery = Sample.	95.9	5.130 mg/L 5.130 mg/L 5.130 mg/L 5.480 mg/L	95.00 2.4 102.60 102.60 109.60
27-Aug-90 27-Aug-90 Number of Samples # 4 Method: ICP Metals by \$W6010 Matrix: Solid Unalyte: Chromium Mype of Control Sample: Calibration Control S Mi-May-90 Mi-May-90 Mi-May-90 Mi-May-90	\$.000 mg/L \$.000 mg/L Mean X Recovery = Sample. 5.000 mg/L 5.000 mg/L	95.9	5.130 mg/L 5.130 mg/L 5.130 mg/L 5.480 mg/L 5.200 mg/L	95.00 2.4 102.60 102.60 109.60 104.00
27-Aug-90 27-Aug-90 Number of Samples # 4 Method: ICP Metals by \$W6010 Matrix: Solid Malyte: Chromium Mype of Control Sample: Calibration Control S May-90 May-90 May-90 May-90 May-90 May-90 May-90	\$.000 mg/L \$.000 mg/L Mean X Recovery = Sample. 5.000 mg/L 5.000 mg/L 5.000 mg/L	95.9	5.130 mg/L 5.130 mg/L 5.130 mg/L 5.480 mg/L 5.200 mg/L 5.140 mg/L	95.00 2.4 102.60 102.60 109.60 104.00 102.80
27-Aug-90 27-Aug-90 Number of Samples = 4 Method: ICP Metals by SW6010 Matrix: Solid Unalyte: Chromium Mype of Control Sample: Calibration Control S Mi-May-90	5.000 mg/L 5.000 mg/L Mean X Recovery = 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L	95.9	5.130 mg/L 5.130 mg/L 5.130 mg/L 5.130 mg/L 5.200 mg/L 5.200 mg/L 5.140 mg/L 5.070 mg/L	95.00 2.4 102.60 102.60 109.60 104.00 102.80 101.40
Number of Samples = 6 Hethod: ICP Metals by \$86010 Hatrix: Solid Haalyte: Chromium Type of Control Sample: Calibration Control S 21-May-90 23-May-90 23-May-90 28-May-90 28-May-90 19-May-90	5.000 mg/L 5.000 mg/L Mean X Recovery = 5.000 mg/L	95.9	5.130 mg/L 5.130 mg/L 5.130 mg/L 5.130 mg/L 5.480 mg/L 5.200 mg/L 5.140 mg/L 5.070 mg/L 4.650 mg/L	95.00 2.4 102.60 102.60 109.60 104.00 102.80 101.40 93.00
27-Aug-90 27-Aug-90 Number of Samples = 6 Method: ICP Metals by \$86010 Matrix: Solid Analyte: Chromium Type of Control Sample: Calibration Control S 21-May-90 21-May-90 23-May-90 28-May-90 28-May-90 28-May-90	5.000 mg/L 5.000 mg/L Mean X Recovery = 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L 5.000 mg/L	95.9	5.130 mg/L 5.130 mg/L 5.130 mg/L 5.130 mg/L 5.200 mg/L 5.200 mg/L 5.140 mg/L 5.070 mg/L	95.00 2.4 102.60 102.60 109.60 104.00 102.80 101.40

Table F4 (Continued)

Date	True Velue		Det Flag	Measured Value	% Recovery
and the second of the State of					
Method: ICP Metals by SW6010 Matrix: Solid					
Analyte: Chromium					
Type of Control Sample: Calibration Cont	Thi Sample, continue	ત			
ype of control selection control	. St. Saipte: Caltinue	•			
29-May-90	5.000	Rg/L		4.770 mg/L	95.40
29-Hay-90	. 5,000	mg/L		4.890 mg/L	97.80
29-Nay-90	5.000	mg/L		4.810 mg/L	96.20
9-#ay-90	5.000	mg/L		4.830 mg/L	96.60
11-Hay-90	5.060	mg/L		5.140 mg/L	102.80
1-May-90	5.000	mg/L		5.110 mg/L	102.20
01-Jun-90	5.000	mg/L		5.100 mg/L	102.00
01-Jun-90	5.000	mg/L		5.110 mg/L	102.20
11-Jun-90	5.000	mg/L		5.090 mg/L	101.80
12-Jun-90	5.000	mg/L		5.120 mg/L	102.40
12-Jun-90	5.000	mg/L		5.010 mg/L	100.20
2-Jun-90	5.000	mg/L		5.030 mg/L	100.60
3-34:1-90	5.000	mg/L		5.130 mg/L	102.60
3-Jun-90	5.000	mg/L		5.170 mg/L	103.40
3-Jun-90	5.000	mg/L		5.180 mg/L	103.50
3-Jun-90	5.000	mg/t.		5.070 mg/L	101.40
4-Jun-90	5.000	mg/L		4.980 mg/L	99.60
4-Jun-90	5.000	mg/L		5.070 mg/L	101.40
7-Jun-90	5.000	mg/L		4.980 mg/L	99.60
7-Jun-90	5.000	mg/L		5.060 mg/L	101.20
9-Jun-90	5.000	mg/L		5.120 mg/L	102.40
9-Jun-90	5.000	mg/L		5.140 mg/L	102.80
9-Jun-98	5.000	mg/L		- 5.070 mg/L	101.40
9-Jun-90	5.000	mg/L		5.060 mg/L	101.20
9-Jun-90	5.000	mg/L		5.190 mg/L	101.40
9-Jun-90	5,600	mg/L		5.050 mg/L	101.00
Ø-Jun-90	5.000	mg/L		5.160 mg/L	103.20
0-Jun-90	5.000	mg/L		5.140 mg/L	102.80
1-Jun-90	5.000	mg/L		5.140 mg/L	102.83
1-Jun-90	5.000	mg/L		5.130 mg/L	102.60
5-Jun-90	5.000	mg/L		5.390 mg/L	107.80
5-Jun-90	5.000	Rg/L		5.240 mg/L	104.80
1-Jul-90	5.000	mg/L		5.030 mg/L	101.80
1-Jul-90	5.000	mg/L		5.090 mg/L	101.80
2-Jul-90	5.000	mg/L		5.190 mg/L	103.80
2-Jul-90	5.000	mg/L		5.140 mg/L	102.30
Z-Jul-90	5.000	mg/L		5.020 mg/L	100.40
Z-Jul+90	5.000	mg/L		5.540 mg/L	110.80

Table F4 (Continued)

	True	True		Det Neasured		x x
Date	Value		Flag	Value		Recovery
ethod: ICP Metals by SW6010						
atrix: Solid						
nalyte: Chromium						
ype of Control Sample: Calibration Con	trol Sample, continu	ed .				
2-Jul-90	5.000	ng/L		5.080	mg/L	101.60
2-Jul-90	5.000	mg/L		5.510	mg/L	110.20
2-Jul-90	5.000	mg/L		5.480	mg/L	109.60
?-Jul-90	5.000	mg/L		5.180	mg/L	103.60
3-Jul-90	5.000	mg/L		5.190	mg/L	104.60
5-Jul-90	5.000	mg/L		5.230	mg/L	104.60
'-Jul-90	5.000	mg/L		5.030	ng/L	100.60
'-Jul-90	5.000	mg/L		5.150	mg/L	103.00
'-Jul-90	5,000	mg/L		5.180	-	103.60
'-Jul-90	5.000	mg/L		4.960	-	99.20
-Jul-90	10.0	mg/L		10.100	-	101.00
-Jut-90	5.000	mg/L		4.940	•	98.80
-Jul-90	5.000	mc/L		5.100	-	102.00
-Jul-90	5.000	mg/L		4.910	-	98.20
-Jul -90	5.000	mg/L		5.100		102.00
-Jul-90	10.0	mg/L		10.200		102.00
-Jul-90	5.000	mg/L		5.190		103.30
Jul-90	5.000	mg/L		4.960		99.20
-Jul-90	5.000	mg/L		5.210 #		104.20
-Jul-90	5.000	mg/L		5,080 #	ng/L	101.60
Jul-90	5,000	mg/L		5.230 m	ng/L	104.60
Jut-90	5.000	mg/L		5.200 #	mg/L	164.00
· Jul -90	5.000	mg/L		5.010 m	7/L	100.20
·Jut -90	5.000	mg/L		5.190 m	19/L	103.80
Jul -90	10.0	mg/L		10.100 m	¥g/L	101.00
Aug-90	5.000	mg/L		4.790 m	1 9/L	95.80
Aug-90	10.0	mg/L		9.920 π	≒ g/L	99.20
Aug-90	5.000	mg/L		4.840 #	19/L	96.83
Aug-90	5.000	mg/L		4.770 #	g/L	95.40
Oct: 90	10.0	ang/L		9.960 #	g/L	99.60
Oct-90	5.000	mg/L		4.890 #		97.80
Oct-90	5.000	mg/L		5.160 m		103.20
e of Control Sample: Laboratory Contro	ol Sample.					
Jul-90	1.000	mg/L		0.930 m	g/L	93.00
- Jul - 90	1.000	ma/t		0.990 m	m/L	99.00

Table F4 (Continued)

	True	Det	Measured	*	
pate	Value	Flag	Value	Recovery	
dethod: ICP Metals by SWK010					
Matrix: Solid					
Analyte: Chromium					
Type of Control Sample: Laboratory	Control Sample, continued				
Number of Sample	s # 81 Nesn % Recov	ery = 101.5	CA (X) =	3.4	
Veebade 100 Magazin har 61/4040					
Method: ICP Metals by SW6010					
Matrix: Solid					
Analyte: Iron					
Type of Control Sample: Calibration	Control Sample.				
21-Hay-90	5.000	mg/L	5.120 mg/L	102.40	
21-Hay-90	5.000	mg/L	5.110 mg/L	102.20	
23-May-90		ng/L	5.430 mg/L	108.60	
23-xay-90		mg/L	5.180 mg/L	103.60	
28-Hay-90		mg/L	5.050 mg/L	101.00	
28-May-90		mg/L	5.150 mg/L	103.00	
29-Hay-90		ng/L	4.710 mg/L	94.20	
29-Hay-90		mg/L	4.610 mg/L	92.20	
29-May-90		mg/L	4.880 mg/L	97.60	
29-Hay-90		mg/L	4.730 mg/L	94.60	
29-Hay-90	5.000	•	4.780 mg/L	95.60	
29-Hay-90	5.000		4.820 mg/L	96.40	
29-May-90		ng/L	4.720 mg/L	94.40	
31-Hay-90		ng/L	5.130 mg/L	102.60	
31-May-90		mg/L	5.180 mg/L	103.60	
01-Jun-90		ng/L	5.080 mg/L	101.60	
01-Jun-90		ng/L	5.210 mg/L	104.20	
01-Jun-90		ng/L	5.170 mg/L	103.40	
31-Jun-90		ng/L	5.180 mg/L 5.050 mg/L	103.60	
02-Jun-91 02-Jun-90		ng/L	5.050 mg/L 4.960 mg/L	101.00 99.20	
25-1un-90		mg/L	5.160 mg/L	103.20	
12-1un-90		mg/L mg/L	5.060 mg/L	103.20	
33-3un-90		=	5.120 mg/L	101.20	
)3-Jun-90		mg/L mg/L	5.020 mg/L	102.40	
03-1/m-50 13-1/m-50		mg/L mg/L	5.100 mg/L	102.00	
13-110n-20 4-110n-20		ng/L ng/L	4.940 mg/L	98.80	
14-1m-50		ng/L ng/L	5.020 mg/L	100.40	
7-Jun-90		-	4.950 mg/L	99.00	
וייין ווייין	5.000	ng/L	770 mg/L	77.40	

Table F4 (Continued)

Date				Det	Measured	X X
		True Value		Flag	Value	Recovery
lethod: ICP Hetal	s by \$46010					
tetrix: Solid						
Analyte: Iron						
ype of Control S	ample: Calibration Control S	ample, continue	ed .			
25-Jul-90		200.0	mg/L		202.000 mg/L	101.00
25-Jul-90	•	50.0	mg/L		48.200 mg/L	96.40
6-Jul-90		200.0	ng/L		202.000 mg/L	101.00
6-Jul-90		5.000	mg/L		5.180 mg/L	103.60
6-Jul-90		5.000	mg/L		5.210 mg/L	104.20
6-Jul-90		50.0	mg/L		47.000 mg/L	94.00
6-Jul-90		50.0	mg/L		49.200 mg/L	98.40
9-0ct-90		50.0	mg/L		49.500 mg/L	99.00
9-0ct-90		200.0	mg/L		192.000 m₄/L	96.00
9-0ct-90		50.0	mg/L		50.200 mg/L	100.40
ype of Control Sa	ample: Laboratory Control San	mple.				
4-Jul-90		15700.0	mg/Y.g	1	6900.000 mg/Kg	107.64
6-Jul- 90		10.0	ag/L		10.200 mg/L	102.00
	Number of Samples = 79	Hean % Reco	very *	101.0	CV (X) =	3.4
ethod: ICP Metals	• '	Mean % Reco	wery =	101.0	CV (X) =	3.4
etrix: Solid	• '	Mean I Reco	wery #	101.0	CV (X) =	3.4
	• '	Mean % Reco	very *	101.0	CV (X) =	3.4
etrix: Solid nelyte: Lead	• '		wery #	101.0	CV (X) =	3.4
atrix: Solid malyte: Lead upe of Control Sa I-May-90	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	mple. 5.000	m g/L	101.0	5.160 mg/L	103.20
atrix: Solid nelyte: Lead ype of Control Sa 1-May-90 1-Nev-90	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	mple. 5.000 5.000	mg/L mg/L	101.0	5.160 mg/L 5.150 mg/L	103.20 103.00
atrix: Solid nelyte: Lead ype of Control Sa 1-May-90 1-Nev-90	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	5.000 5.000 5.000	mg/L mg/L කැ/L	101.0	5.160 mg/L 5.150 mg/L 5.070 mg/L	103.20 105.00 101.40
atrix: Solid helyte: Lead ype of Control Sa 1-May-90 1-Nay-90 5-May-90	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	mple. 5.000 5.000	mg/L mg/L කැ/L	101.0	5.160 mg/L 5.150 mg/L	103.20 103.00
strix: Solid helyte: Lead ope of Control Sa -May-90 -May-90 -May-90 -May-90	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	5.000 5.000 5.000	mg/L mg/L mg/L mg/L	101.0	5.160 mg/L 5.150 mg/L 5.070 mg/L	103.20 105.00 101.40
strix: Solid helyte: Lead /pe of Control Sa -May-90 -May-90 -May-90 -May-90 -May-90	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L	101.0	5.160 mg/L 5.150 mg/L 5.070 mg/L 5.460 mg/L	103.20 103.00 101.40 109.20
etrix: Solid helyte: Lead pe of Control Sa -May-90 -Nev-90 -May-90 -May-90 -May-90 -May-90 -May-90	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L	101.0	5.160 mg/L 5.150 mg/L 5.070 mg/L 5.460 mg/L 5.150 mg/L	103.20 105.00 101.40 109.20 103.00
atrix: Solid helyte: Lead upe of Control Sa I-May-90 I-Nev-90 I-May-90	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L	101.0	5.160 mg/L 5.150 mg/L 5.070 mg/L 5.460 mg/L 5.150 mg/L 4.900 mg/L	103.20 103.00 101.40 109.20 103.00 98.00
atrix: Solid helyte: Lead ype of Control Sa 1-May-90 1-Ney-90 5-May-90 5-May-90 3-May-90 3-May-90 2-May-90 2-May-90	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L	101.0	5.160 mg/L 5.150 mg/L 5.070 mg/L 5.460 mg/L 5.150 mg/L 4.900 mg/L 4.620 mg/L	103.20 105.00 101.40 109.20 103.00 98.00 92.40
atrix: Solid helyte: Lead ype of Control Sa 1-May-90 1-Nev-90 5-May-90 3-May-90 3-May-90 7-May-90 7-May-90 7-May-90 7-May-90	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	101.0	5.160 mg/L 5.150 mg/L 5.070 mg/L 5.460 mg/L 5.150 mg/L 4.900 mg/L 4.620 mg/L 4.750 mg/L	103.20 103.00 101.40 109.20 103.00 98.00 92.40 95.00
etrix: Solid nelyte: Lead	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	101.0	5.160 mg/L 5.150 mg/L 5.070 mg/L 5.460 mg/L 5.150 mg/L 4.900 mg/L 4.620 mg/L 4.750 mg/L 4.730 mg/L	103.20 103.00 101.40 109.20 103.00 98.00 92.40 95.00 94.60
atrix: Solid nelyte: Lead ype of Control Sa 1-May-90 1-Ney-90 3-May-90 3-May-90 3-May-90 7-May-90 7-May-90 7-May-90 7-May-90 7-May-90 7-May-90	s by \$\text{\$\}\$}}}}}\$}}}}}}}}}}}}}}}}}}}}}}}}}}}}	5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	101.0	5.160 mg/L 5.150 mg/L 5.070 mg/L 5.460 mg/L 5.150 mg/L 4.900 mg/L 4.620 mg/L 4.750 mg/L 4.750 mg/L 4.820 mg/L	103.20 103.00 101.40 109.20 103.00 98.00 92.40 95.00 94.60 96.40

Table F4 (Continued)

	True	Det	Measured	x	
Date	Value	Flag		Recovery	
lethod: ICP Metals by SW5010					
letrix: Solid					
inelyte: Lead					
ype of Control Sample: Calibration Con	itrol Sample, continue	đ			
i1-¥ay-90	5.000	mg/L	5.110 mg/L	102.20	
11-Hay-50	5,000	mg/L	5.060 mg/L	101.20	
11-Jun-90	5,000	mg/L	5.100 mg/L	102.00	
11-Jun-90	5.000	mg/L	5.070 mg/L	101 40	
1-Jun-90	5.000	mg/L	5.120 mg/L	102.40	
2-Jun-90	5,000	mg/L	4.960 mg/L	99.20	
2-Jun-90	5.000	mg/L	4,940 mg/L	98.80	
12-Jun-90	5.000	ang/L	4.990 mg/L	99.80	
3-Jun-90	5.000	mg/L	5,120 mg/L	102.40	
3-Jun-90	5.000	mg/L	5.060 mg/L	101.23	
3-Jun-90	5.000	mg/L	5.030 mg/L	100.60	
3-Jun-90	5.000	mg/L	5.050 mg/L	101.00	
4-Jun-90	5.000	mg/L	5,050 mg/L	101.00	
4-Jun-90	5.000	MQ/L	4,900 mg/L	98.00	
7-Jun-90	5.000	mg/L	5,060 mg/L	101.20	
7-Jun-90	5.000	mg/L	4,910 mg/L	98.20	
9-Jun-90	5.000	mg/L	5,100 mg/L	102.00	
9-Jun-90	5.000	rg/L	5,060 mg/L	101.20	
9-Jun-90	5.000	mg/L	5,170 mg/L	103.40	
9-Jun-90	5.000	mg/L	5.130 mg/L	102.60	
9-Jun-90	5.000	EQ/L	5.110 mg/L	102.20	
9-Jun-90	5.000	mg/L	5.150 mg/L	103.00	
0-Jun-90	5.000	mg/L	5.120 mg/L	102.40	
0-Jun-90	5.000	mg/L	5.110 mg/L	102.20	
1-Jun-90	5.000	mg/L	5.160 mg/L	103.20	
1-Jun-90	5,000	mg/L mg/L	5.170 mg/L	103.40	
5-Jun-90	5.000	mg/L	5.210 mg/L	104.20	
5-Jun-90	5.000	ng/L	5.360 mg/L	107.20	
1-Jul-90	5.000	ang/L	5.130 mg/L	102.60	
1-Jul-90	5.000	Rig/L	5.150 mg/L	103.00	
7-341-90 Z-Jul-90	5.000	-	5.030 mg/L	100.60	
2-Jul-90	5.000	mg/L	5.130 mg/L	102.60	
2-301-90	5.000	ang/L		102.20	
		mg/L	5.110 mg/L		
2-Jul-90	5.000	mg/L	5.120 mg/L	102.40	
2-Jul-90	5.000	NG/L	5.220 mg/L	104.40	
Z-Jut-90	5.000	Hg/L	5.500 mg/L	110.00	
?-Jul-90	5.000	mg/L	5.430 mg/L	108.60	
?-Jul-90	5.000	MQ/L	5.490 mg/L	109.80	

Table F4 (Continued)

14-Jul-90 14-Jul-90 14-Jul-90 14-Jul-90 15-Jul-90 15-Jul-90 15-Jul-90 16-Jul-90 16-Jul-90 16-Jul-90 16-Jul-90 16-Jul-90 16-Jul-90 16-Jul-90 17-Aug-90	5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	5.230 mg/L 5.110 mg/L 5.170 mg/L 5.270 mg/L 5.190 mg/L 5.130 mg/L 5.200 mg/L 10.100 mg/L 4.590 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.170 mg/L 5.190 mg/L 10.100 mg/L 5.090 mg/L	104.60 102.20 103.40 105.40 103.80 102.60 104.00 101.00 97.80 101.00 97.60 101.00 103.40 102.20 101.00
Inalyte: Lead Type of Control Sample: Calibration Control Sample: 3-Jul-90 3-Jul-90 7-Jul-90 7-Jul-90 7-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 7-Aug-90	5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	5.110 mg/L 5.170 mg/L 5.270 mg/L 5.270 mg/L 5.190 mg/L 5.130 mg/L 5.200 mg/L 10.100 mg/L 4.890 mg/L 4.890 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.170 mg/L 5.190 mg/L 5.090 mg/L	102.20 103.40 105.40 103.80 102.60 104.00 101.00 97.80 100.20 99.80 101.00 97.60 100.40 103.40 102.20
Type of Control Sample: Calibration Control Sample: 3-Jul-90 3-Jul-90 7-Jul-90 7-Jul-90 7-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 7-Aug-90	5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	5.110 mg/L 5.170 mg/L 5.270 mg/L 5.270 mg/L 5.190 mg/L 5.130 mg/L 5.200 mg/L 10.100 mg/L 4.890 mg/L 4.890 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.170 mg/L 5.190 mg/L 5.090 mg/L	102.20 103.40 105.40 103.80 102.60 104.00 101.00 97.80 100.20 99.80 101.00 97.60 100.40 103.40 102.20
3-Jul-90 3-Jul-90 7-Jul-90 7-Jul-90 7-Jul-90 7-Jul-90 7-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90	5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	5.110 mg/L 5.170 mg/L 5.270 mg/L 5.270 mg/L 5.190 mg/L 5.130 mg/L 5.200 mg/L 10.100 mg/L 4.890 mg/L 4.890 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.170 mg/L 5.190 mg/L 5.090 mg/L	102.20 103.40 105.40 103.80 102.60 104.00 101.00 97.80 100.20 99.80 101.00 97.60 100.40 103.40 102.20
3-Jul-90 7-Jul-90 7-Jul-90 7-Jul-90 7-Jul-90 7-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90	\$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	5.110 mg/L 5.170 mg/L 5.270 mg/L 5.270 mg/L 5.190 mg/L 5.130 mg/L 5.200 mg/L 10.100 mg/L 4.890 mg/L 4.890 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.170 mg/L 5.190 mg/L 5.090 mg/L	102.20 103.40 105.40 103.80 102.60 104.00 101.00 97.80 100.20 99.80 101.00 97.60 100.40 103.40 102.20
7-Jul-90 7-Jul-90 7-Jul-90 7-Jul-90 7-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90	\$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000 \$.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	5.170 mg/L 5.270 mg/L 5.270 mg/L 5.190 mg/L 5.130 mg/L 5.200 mg/L 10.100 mg/L 4.890 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.170 mg/L 10.100 mg/L 5.090 mg/L	103.40 105.40 103.80 102.60 104.00 101.00 97.80 100.20 99.80 101.00 97.60 103.40 102.20
7-Jul-90 7-Jul-90 7-Jul-90 7-Jul-90 14-Jul-90 14-Jul-90 14-Jul-90 14-Jul-90 15-Jul-90 15-Jul-90 15-Jul-90 15-Jul-90 16-Jul-90	5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	5.270 mg/L 5.190 mg/L 5.130 mg/L 5.200 mg/L 10.100 mg/L 4.890 mg/L 5.010 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.110 mg/L 10.100 mg/L 5.090 mg/L	105.40 103.80 102.60 104.00 101.00 97.80 100.20 99.80 101.00 97.60 100.40 103.40 102.20
7-Jul-90 7-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90	5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	5.190 mg/L 5.130 mg/L 5.200 mg/L 10.100 mg/L 4.890 mg/L 5.010 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.110 mg/L 10.100 mg/L 5.090 mg/L	103.80 102.60 104.00 101.00 97.80 100.20 99.80 101.00 97.60 100.40 103.40 102.20
7-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 4-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90	5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	5.130 mg/L 5.200 mg/L 10.100 mg/L 4.890 mg/L 5.010 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.110 mg/L 10.100 mg/L 5.090 mg/L	102.60 104.00 101.00 97.80 100.20 99.80 101.00 97.60 100.40 103.40 102.20
24-Jul-90 24-Jul-90 24-Jul-90 24-Jul-90 25-Jul-90 25-Jul-90 25-Jul-90 25-Jul-90 26-Jul-90 26-Jul-90 26-Jul-90 26-Jul-90 26-Jul-90 26-Jul-90 27-Aug-90	5.000 10.0 5.000 5.000 5.000 10.0 5.000 5.000 5.000 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	5,200 mg/L 10.100 mg/L 4,890 mg/L 5,010 mg/L 4,990 mg/L 10,100 mg/L 4,880 mg/L 5,020 mg/L 5,170 mg/L 5,110 mg/L 10,100 mg/L 5,090 mg/L	104.00 101.00 97.80 100.20 99.80 101.00 97.60 100.40 103.40 102.20
24-Jul-90 24-Jul-90 24-Jul-90 24-Jul-90 25-Jul-90 25-Jul-90 25-Jul-90 25-Jul-90 26-Jul-90 26-Jul-90 26-Jul-90 26-Jul-90 26-Jul-90 26-Jul-90 27-Aug-90 27-Aug-90	10.0 5.000 5.000 5.000 10.0 5.000 5.000 5.000 10.0 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	10.100 mg/L 4.890 mg/L 5.010 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.110 mg/L 10.100 mg/L 5.090 mg/L	101.00 97.80 100.20 99.80 101.00 97.60 100.40 103.40 102.20 101.00
4-Jul-90 4-Jul-90 4-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90	5.000 5.000 10.0 5.000 5.000 5.000 5.000 10.0 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	4.890 mg/L 5.010 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.110 mg/L 10.100 mg/L 5.090 mg/L	97.80 100.20 99.80 101.00 97.60 100.40 103.40 102.20 101.00
4-Jul-90 4-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90	5.000 5.000 10.0 5.000 5.000 5.000 10.0 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	5.010 mg/L 4.990 mg/L 10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.110 mg/L 10.100 mg/L 5.090 mg/L	100.20 99.80 101.00 97.60 100.40 103.40 102.20 101.00
4-Jul 90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90	5.000 10.0 5.000 5.000 5.000 10.0 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L mg/L	4,990 mg/L 10.100 mg/L 4,880 mg/L 5.020 mg/L 5.170 mg/L 5.110 mg/L 10.100 mg/L 5.090 mg/L	99.80 101.00 97.60 100.40 103.40 102.20 101.00
5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90	10.0 5.000 5.000 5.000 5.000 10.0 5.000 5.000	mg/L mg/L mg/L mg/L mg/L mg/L	10.100 mg/L 4.880 mg/L 5.020 mg/L 5.170 mg/L 5.110 mg/L 10.100 mg/L 5.090 mg/L	101.00 97.60 100.40 103.40 102.20 101.00
5-Jul-90 5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90	5.000 5.000 5.000 5.000 10.0 5.000 5.000	mg/L mg/L mg/L mg/L mg/L	4.880 mg/L 5.020 mg/L 5.170 mg/L 5.110 mg/L 10.100 mg/L 5.090 mg/L	97.60 100.40 103.40 102.20 101.00
5-Jul-90 5-Jul-90 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90 7-Aug-90	5.000 5.000 5.000 10.0 5.000 5.000	mg/L mg/L mg/L mg/L mg/L	5.020 mg/L 5.170 mg/L 5.110 mg/L 10.100 mg/L 5.090 mg/L	100.40 103.40 102.20 101.00
5-Jul-70 5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90 7-Aug-90	5.000 5.000 10.0 5.000 5.000	mg/L mg/L mg/L mg/L	5.170 mg/L 5.110 mg/L 10.100 mg/L 5.090 mg/L	103.40 102.20 101.00
5-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90 7-Aug-90	5.000 10.0 5.000 5.000	mg/L mg/L mg/L	5.110 mg/L 10.100 mg/L 5.090 mg/L	102.20
6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90 7-Aug-90	10.0 5.000 5.000	mg/L mg/L	10.100 mg/L 5.090 mg/L	101.00
6-Jul-90 6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90 7-Aug-90	5.000 5.000	mg/L	5.090 mg/L	
6-Jul-90 6-Jul-90 6-Jul-90 7-Aug-90 7-Aug-90	5.000	•		101.80
6-Jul-90 6-Jul-90 7-Aug-90 7-Aug-90		mg/L		405 /0
6-Jul-90 7-Aug-90 7-Aug-90	5.000		5.270 mg/L	105.40
7-Aug-90 7-Aug-90		mg/L	5,170 mg/L	103.40
7-Aug-90	5.000	mg/L	5.280 mg/L	97.60
-	5.000	mg/L	4.880 mg/L	98.20
7-209-90	10.0	mg/L mg/L	4.910 mg/L 9.980 mg/L	99.80
7-Aug-90	5.000	mg/L mg/L	4.770 mg/L	95.40
8-net-90	10.0	•	9.950 mg/L	99.50
5-0c1-90	5.000	•••	5.260 mg/L	105.20
6-0ct-90	5.000	mg/L	5.110 mg/L	102.20
8-0ct-90	5.000	mg/L	5.370 mg/L	107.40
pe of Control Sample: Laboratory Control Sample.				
6-Jul-90	117.0	mg/Kg	107.000 mg/Kg	91.45
6-Jul-90	1.000		0.980 mg/L	98.00

Table #4 (Continued)

	True	' Measured	x	
Date	Value	Value	Recovery	
Hethod: ICP Metals by SWJ010				
Matrix: Solid				
Inelyte: Nickel				
ype of Control Sample: Calibration Cont	rol Sample.			
21-May-90	5.000 mg/L	5.070 mg/L	101.40	
1-May-90	5.000 mg/L	5.100 mg/L	102.00	
3-May-90	5.000 mg/L	5.160 mg/L	103,20	
3-Hay-90	5.000 mg/L	5.520 mg/L	110.40	
8-May-90	5.300 mg/L	4.990 mg/L	99.80	
8-May-90	5.000 mg/L	5.050 mg/L	101.00	
9-May-90	5.000 mg/L	4.750 mg/L	95.00	
9-May-90	5.000 mg/L	4.700 mg/L	94.00	
9-Hay-90	5.000 mg/L	4.780 mg/L	95,60	
9-May-90	5.000 mg/L	4,580 mg/L	91.60	
9-May-90	5.000 mg/L	4.700 mg/t	94.00	
9-May-90	5.000 mg/L	4.700 mg/L	94.00	
9-May-90	5.000 mg/L	4.840 mg/L	96.80	
-May-90	5.000 mg/L	5,040 mg/L	100.80	
-May-90	5.000 mg/L	5,080 mg/L	101,60	
-Jun-90	5.000 mg/L	5.070 mg/L	161,40	
-Jun-90	3.000 mg/L	5.090 mg/L	101.80	
-Jun-90	5.000 mg/L	5.050 mg/L	101.00	
-Jun-90	5.000 mg/L	5.120 mg/L	102.40	
-Jun-90	5.000 mg/L	5.150 mg/L	103.00	
-Jun-90	5.000 mg/L	5.080 mg/L	101.60	
- Jun-90	5.000 mg/L	4.980 mg/L	99.60	
-Jun-90	5.000 mg/L	5.040 mg/L	100.80	
-Jun-90	5.000 mg/L	5.240 mg/L	104.80	
-Jun-90	5.000 mg/L	5.250 mg/L		
-Jun-90	5.000 mg/L	5.220 mg/L	105.00	
- Jun-90		4.880 mg/L	104,40	
- Jun-90			97.60	
-Jin-90		5.010 mg/L	100.20	
Jun-90		4.920 mg/L	98.40	
Jun-90	*	5.810 mg/L	100.20	
Jun-90	<u>.</u>	5.150 mg/L	103.00	
Jun-90	5,000 mg/L	5.130 mg/L	102.60	
Jun-90	5.000 mg/L	5.040 mg/L	100.80	
Jun-90	5.000 mg/L	5.110 mg/L	102.20	
Jun-90	5.000 mg/L	5.000 mg/L	100.00	
Jun-90	5.000 mg/L	5.110 mg/L	102.20	
Jun-90	5.000 mg/L	5.090 mg/L	101.80	
3 年 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	5.000 mg/L	5.050 mg/L	101.00	

Table F4 (Continued)

	True	True		Det Hemsured	
Date	Value		Flag	Velue	Re.uve
ethod: ICP Metals by SW6010					
etrix: Solid					
nelyte: Nickel					
ype of Control Sample: Calibra	tion Control Sample, continue	đ			
1-Jun-90	5.000	mg/L		5.010 m/L	100,10
5-Jun-90	5.000	mg/L		5.440 Ful	108,70
5-Jun-90	5.000	mg/L		5.220 m/L	٠٠
?-Jul-90	5.000	mg/L		5.003 File	111,
?-Jul-90	5.003	mg/L		5.120 mg/L	33.11
?-Jul-90	5.000	mg/L		5,410 mg/L	:: .
?- Jul -90	5.003	mg/L		5.080 mg/L	¢ -0
?- Jul - 9 0	5.000	my/L		5.440 mg/L	° `≥.80
!- Jul -90	5.000	Raj/L		5.040 mg/L	10.80
-Jul-90	5.000	mg/L		5.400 mc/L	108.00
-Jul-90	5.000	mg/L		5.120 mg/L	102.40
-Jul-90	5.000	ng/L		4.910 mg/L	98.20
-Jut-90	5.000	mg/L		5.070 mg/L	101.40
-Jul-90	5.000	mg/L		5.040 mg/L	100.80
-Jul -90	5.000	mg/L		5.120 mg/L	102.40
-Jul-90	5.000	mg/L		5.200 mg/L	104.00
-Jul-40	5,000	mg/L		5.200 mg/L	104.00
- Jul - 9 0	5.000	ng/L		4.930 mg/L	98.60
Jul-90	5.000	mg/L		4.980 mg/L	99.60
-Jul-90	10.0	mg/L		10.100 mg/L	101.00
- Jul - 90	10.0	mg/L		10.100 mg/L	101.00
· Jnf - 60	5.000	mg/L		4.990 mg/L	99.80
- Jnf - 60	5.000	mg/L		4.830 mg/L	96.60
- Jul - 90	5.000	mg/L		5.080 mg/L	101.60
-Jul-Su	5.000	mg/L		5.130 mg/L	102.60
· Jul -90	5.000	ng/L		4.970 mg/L	99.40
·Jul-90	10.0	mg/L		10.100 mg/L	101.00
Jul-90	5.000	mg/L		5.120 mg/L	102.40
Jul -90	5.000	ng/L		5.170 mg/L	103.40
Jul-90	5.000 1	mg/L		5.180 mg/L	103.60
Oct-90	5.000	mg/L		5.350 mg/L	107.00
-Oct-90		mg/L		5.080 mg/L	101.60
Oct-90		ng/L		5.180 mg/L	103.60
Oct-90	10.0	ng/L		9.540 mg/L	99.40

Table F4 (Continued)

8.00	True Value	Det Flac	Rensured Value	% Recover
Date	12100	7185		
Method: ICP Metals by SM6010				
Matrix: Solid				
Analyte: Nickel				
Type of Control Sample: Laborator	ry Control Sample, continued			
Type of Control Sample: Laborator	ry Control Sample.			
24-Jul-90	225.0 mg/Kg	;	184.000 mg/Kg	81.78
26-Jul-97	1.000 mg/L		1.300 mg/L	100.00
Number of Samo	ples = 74 Hean % Recovery :	101.0	CV (%) *	4.1
Method: ICP Metals by SW6010				
Metrix: Solid				
Analyte: Silver				
Type of Control Sample: Calibrati	ion Control Sample.			
27-Aug-90	5.000 mg/L		4.880 mg/L	97.60
	40.0		9.890 mg/L	98.90
27-Aug-90	10.0 mg/L			
27-Aug-90	5,000 mg/L		4.820 mg/L	96.40
7-Aug-90			4.820 mg/L 4.860 mg/L	96.40 97.20
27-Aug-90 27-Aug-90 27-Aug-90 Nurzer of Sanc	5.000 mg/L 5.000 mg/L	97.5	-	
27-Aug-90 27-Aug-90	5.000 mg/L 5.000 mg/L ples = 4 Mean X Recovery =		4.860 mg/L	97.20
27-Aug-90 27-Aug-90 Number of Samo	5.000 mg/L 5.000 mg/L ples = 4 Mean X Recovery =		4,860 mg/L CV (%) =	97.20
27-Aug-90 27-Aug-90 Number of Samo Method: ICP Metals by SW6010	5.000 mg/L 5.000 mg/L ples = 4 Mean X Recovery =		4,860 mg/L CV (%) =	97.20
27-Aug-90 27-Aug-90 Number of Samo Rethod: ICP Metals by SW6010 Retrix: TREATED	5.000 mg/L 5.000 mg/L ples = 4 Mean X Recovery =		4,860 mg/L CV (%) =	97.20
27-Aug-90 27-Aug-90 Number of Samo	5.000 mg/L 5.000 mg/L Dies = 4 Mean X Recovery s		4,860 mg/L CV (%) =	97.20
27-Aug-90 27-Aug-90 Number of Same Rethod: ICP Metals by SW6010 Retrix: TREATED nelyte: Sarium ype of Control Samole: Calibrati	5.000 mg/L 5.000 mg/L ples = 4 Mean X Recovery a ion Control Sample. 5.000 mg/L		4,860 mg/L CV (%) =	97.20
27-Aug-90 27-Aug-90 Number of Samo Number of Samo Nethod: ICP Metals by SW6010 Natrix: TREATED Inalyte: Barium Nype of Control Samole: Calibrati W-Sep-90 W-Sep-90	5.000 mg/L 5.000 mg/L ples = 4 Mean X Recovery a ion Control Sample. 5.000 mg/L 5.000 mg/L		4.860 mg/L CV (%) = 5.050 mg/L 5.040 mg/L	97.20
Number of Same Number of Same Number of Same Nethod: ICP Metals by SW6010 Natrix: TREATED Inalyte: Barium Nype of Control Sample: Calibrati W-Sep-90 W-Sep-90 W-Sep-90	5.000 mg/L 5.000 mg/L ples = 4 Mean X Recovery = ion Control Sample. 5.000 mg/L 5.000 mg/L 10.0 mg/L		5.050 mg/L 5.050 mg/L 9.940 mg/L	97.20 1.1 101.00 100.80 99.40
Number of Same Number of Same Number of Same Nethod: ICP Metals by SW6010 Natrix: TREATED Inalyte: Barium Nype of Control Sample: Calibrati W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90	5.000 mg/L 5.000 mg/L ples = 4 Mean X Recovery = ion Control Sample. 5.000 mg/L 5.000 mg/L 10.0 mg/L 5.000 mg/L		5.050 mg/L 5.050 mg/L 5.040 mg/L 9.940 mg/L 4.890 mg/L	97.20 1.1 101.00 100.80 99.40 97.80
Number of Same Number of Same Number of Same Nethod: ICP Metals by SW6010 Natrix: TREATED Inalyte: Barium Nype of Control Sample: Calibrati W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90	5.000 mg/L 5.000 mg/L ples = 4 Mean X Recovery = ion Control Sample. 5.000 mg/L 5.000 mg/L 10.0 mg/L 10.0 mg/L 10.0 mg/L		5.050 mg/L 5.050 mg/L 5.040 mg/L 9.940 mg/L 9.820 mg/L 9.820 mg/L	97.20 1.1 101.00 100.80 99.40 97.80 98.20
Attrict TREATED Inalyte: Janius Winser of Samo Number of Sam	5.000 mg/L 5.000 mg/L ples = 4 Mean X Recovery = 5.000 mg/L 5.000 mg/L 10.0 mg/L 10.0 mg/L 10.0 mg/L 5.000 mg/L 10.0 mg/L 5.000 mg/L		5.050 mg/L 5.050 mg/L 5.040 mg/L 9.940 mg/L 4.890 mg/L 9.820 mg/L 4.960 mg/l	97.20 1.1 101.00 100.80 99.40 97.80 98.20 99.20
Number of Same Number of Same Number of Same Nethod: ICP Metals by SW6010 Natrix: TREATED Inalyte: Barium Nype of Control Sample: Calibrati W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90 W-Sep-90	5.000 mg/L 5.000 mg/L ples = 4 Mean X Recovery = ion Control Sample. 5.000 mg/L 5.000 mg/L 10.0 mg/L 10.0 mg/L 10.0 mg/L		5.050 mg/L 5.050 mg/L 5.040 mg/L 9.940 mg/L 9.820 mg/L 9.820 mg/L	97.20 1.1 101.00 100.80 99.40 97.80 98.20

Table F4 (Continued)

	True	Det Measured	x
Date	Value	Flag Value	Recovery
Method: ICP Metals by SW6010			
Matrix: TREATED			
Analyte: Barium			
Type of Control Sample: Calibration (Control Sample, continued		
03-0ct-90	5.000 Fg/L	4.870 mg/L	97.40
Type of Control Sample: Laboratory Co	ontrol Sample.		
03-0ct-90	1.000 mg/L	1.020 mg/l	102.00
Number of Samples	= 10 Mcan % Recovery = 5	9.7 CV (%) =	1.6
Method: ICP Metats by Sw6010			
Matrix: TREATED			
Unelyte: Cadmium			
yes of Control Sample: Calibration C	ontrol Sample,		
¼-Sep-90	5.000 mg/L	4.980 mg/L	9 9.60
4-Sep-90	10.0 mg/L	9.950 mg/L	99.50
4-5ep-90	5.000 mg/L	4.850 mg/L	97.00
4-5ep-90	5.000 mg/L	4.860 mg/L	97.20
3-0ct-90	5.000 mg/L	4.650 mg/t	93.00
3-0et-90	5.000 mg/L	4.610 mg/l	92.20
3-0ct-90	10.0 mg/L	9.830 mg/l	98.30
3-0ct-90	5.000 mg/L	4.580 mg/l	91.60
	5.000 mg/L	4.610 mg/L	92.20
3-0ct-90			
	ntrol Sample.		
3-Oct-90 ype of Control Sample: Laboratory Cor 3-Oct-90	ntrol Sample. 1.000 mg/L	1.02V mg/t	102.00

Table F4 (Continued)

***************************************	andanaanaanaanaanaanaanaanaa True	Det Measured	% Recovery
Date	Value	Flag Value	Recovery
ethod: ICP Metals by 5W6010			
atrix: TREATED			
nelyte: Chromium			
ype of Control Sample: Calibration Cont	rol Sample.		
¼-\$ ep-90	5.000 mg/L	5.080 mg/L	101.60 99.50
4-5ep-90	10.0 mg/L	9.950 mg/L	99.40
4-5ep-90	5.000 mg/L	4.970 mg/L	100.00
9-520-90	10.0 mg/L	10.000 mg/L	101.60
9-5ep-90	5,000 mg/L	5.080 mg/L	101.20
9-Sep-90	5,000 mg/L	5.060 mg/L	
9-Sep-90	10.0 mg/L	10.000 mg/L	100.00
9-5ep-90	5,000 mg/L	5.110 mg/L	102,20
9-Sep-90	5,000 mg/L	5.200 mg/L	104.00
9-5ep-90	5.000 mg/L	5.330 mq/L	106.60
19-sep-90	5.000 mg/L	4.970 mg/L	99.40
19-5ep-90	5.000 mg/L	5.070 mg/L	101.40
9-5ep-90	5,000 mg/L	5.030 mg/L	100.60
6-Sep-90	5.000 mg/L	5.190 mg/L	103.80
26-5 ep-9 3	5,000 mg/L	5.170 mg/L	103.40
26-Seo-90	5,000 mg/L	5.090 mg/L	101.80
26-Sen-90	10.0 mg/L	10.200 mg/L	102.00
26-\$ep-90	5,000 mg/L	5.140 mg/L	
26-S e 0-90	5.000 mg/L	5.160 mg/L	
26-Sep-90	5,000 mg/L	5.040 mg/l	
26-5 ep-9 0	10.0 mg/L	9.920 mg/l	
26-Sep-90	5.000 mg/L	5.090 mg/l	
26-Sep-90	5,000 mg/L	5.120 mg/1	
26-Sep-90	5,000 mg/L	\$.080 mg/l	
28-Sep-90	5,000 mg/L	4.860 mg/1	
28-Sep-99	10.0 mg/L	10.000 mg/l	
28-Sep-90	5.000 mg/L	4.820 mg/	
- 28-Sep-90	5.000 mg/L	4.660 mg/1	
03-0c1-90	5.000 mg/L	5.040 mg/1	
03-0ct-90	5,000 mg/L	5.070 mg/l	
03-0ct-90	5,000 mg/t	5.000 mg/1	
03-0ct-90	5.000 mg/L		
03-0ct-90	5.000 mg/L		
03-0et-90	5.000 m q/L		
03-0<1-90	10.0 mg/L		
03-0ct-90	5.000 mg/L		
03-001-90	10.0 mg/l	9.900 mg/	L 99.0

Table F4 (Continued)

	True		Det	Messured	x
Date	Value		Flaa	Value	Recovery
Method: ICP Metals by SU6010					
Matrix: TREATED					
Anelyte: Chromium					
Type of Control Sample: Calibra	tion Control Sample, continue	rd .			
03-0ct-90	5.000	KQ/L		4.950 mg/L	99.00
3-0ct-90	5.000	mg/L		4.940 mg/l	98.30
74-0ct-90	5.000	mg/L		5.010 mg/L	100.20
4-0ct-90	5.000	mg/L		5.020 mg/L	100.40
4-0ct-90	5.000	mg/L		4.950 mg/L	99.00
4-0ct-90	10.0	mg/L		9.960 mg/L	99.60
4-0ct-90	1.000	mg/L		1.010 mg/L	101.00
ype of Control Sample: Laborat	ory Control Sample.				
9-Sep-90	0.200	mg/L		0.194 mg/L	97.00
5-Sep-90	1.000	mg/L		0.940 mg/L	94.00
6-Sep-90	67.0	mg/Kg		63.500 mg/Kg	94.78
6-5 ep-9 0	0.500	Mg/L		0.486 mg/L	97.20
8-Sep-90	1.000	mg/L		0.856 mg/l	85.60
8-Sep-90	67.0	mg/Kg		57.000 mg/kg	85.07
3-0ct-90	67.0	mg/L		67.100 mg/L	100.15
3-0ct-90	1.000	mg/L		1.030 mg/L	103.00

Hethod: ICP Hetals by 5W6010

Metrix: TREATED
Analyte: Chromium VI

Type of Control Sample: Calibration Control Sample.

26-Sep-90	10.0 mg/L	10.200 mg/L	102,00

Number of Samples = 1

Heen % Recovery # 102.0

CV (%) =

Table F4 (Continued)

**************************	zzaszzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz	******	******	******	*******	***********
	True		Det	Heasure	d	x
Date	Value		flag	Value		Recovery
Nethod: ICP Metals by \$86010						
Hatrix: TREATED						
Analyte: Iron						
Type of Control Samole: Calibration	Control Sample.					
04-5ep-90	50.0	mg/L		49.200	mg/L	98.40
04-Sep-90	50.0	mg/L		48.600	mg/L	97.20
04-5ep-90	200.0	mg/L		195.000	mg/L	97.50
04-Sep-90	50.0	mg/L		48.100	mg/L	96.20
19-5ep-90	\$0.0	mg/L		50.200	mg/L	100.40
19-5ep-90	50.0	mg/L		50,000	R≥g/L	100.00
19-5ep-90	50.0	mg/L		49.800	mg/L	99.60
19-Sep-90	200.0	mg/L		199.000	mg/L	99.50
19-Sep-90	50.0	mg/L		49,000	mg/L	98.00
19-Sep-90	50.0	mg/L		49.900	mg/L	99.80
20-Sep-90	50.0	mg/L		48.200	mg/L	96.40
20-Sep-90	50.0	mg/L		49.900	mg/L	99.80
20-Sep-90	50.0	mg/L		49,000	mg/L	98.00
20-Sep-90	200.0	ing/L		199.000	mg/L	99.50
20-Sep-90	50.0	hg/L		49.800	mg/L	99.60
20-Sep-97	50.0	mg/L		50.200	mg/L	100.40
26-Sea-90	200.0	mg/L		204.000	mg/L	102.00
26-Sep-90	50.0	mg/L		50.300	mg/L	100.60
26-Sep-90	50.0	mg/L		49.200	ng/L	98.40
26-Sep-90	50.0	mg/L		49.400	mg/L	98,80
26-Sep-90	50.0	PQ/L		49.900	ng/L	99.22
26-Sep-90	50.0	mg/L		49.600	mg/L	99.20
28-5ep-90	50.0	mg/L		47.600	seg/(95.20
28-5ep-90	200.0	mg/L		200.000	mg/l	100.00
28-5 ep-90	50.0	ng/L		48.300	ng/l	96.60
28-5 ep-9 0	50.0	ng/L		47.500	mg/l	95.00
01-0ct-90	200.0	ng/L		193.000	mg/l	96.50
01-0ct-90	50.0	mg/L		48.700	mg/l	97.40
01-0ct-90	50.0	m/L		48.400	mg/l	96.80
01-0ct-90	50.0	mg/L		47.700	ng/L	95.40
3-0ct-99	50.0	mg/L		48.900	mg/L	97.80
03-0ct-90	50.0	mg/L		48.800	Fig/1.	97.50
73-0ct-90	200.0	mg/L		201.000	mg 'L	100.50
03-0ct-90		mq/L		49.600	mj/L	99.20
)3-0ct-90	50.0	ng/L		50.100	mg/L	100.20
3-0ct-90	200.0	mg/L		195.000		97.50
3-0ct-90	50.0	mg/L		49.000	mg/L	98.00
********************	***************************************	******	******	******	*****	*****

Table F4 (Continued)

	True		Det Heasured	x
Date	Value		Flag Value	Recovery
Mathod: ICP Metats by SW6010				
Matrix: IREATED			•	
Analyte: Iron				
Type of Control Sample: Calibration Control:	Sample, continue	ed:		
03-0ct-90	50.0	#e/L	49,100 mg/L	98.20
03-0ct-90	50.0	mg/L	50.100 mg/l	100.20
03-0ct-90	200.0	-	198.000 m/g/l	99.60
03-0ct-90		mg/L	49.500 mg/l	99.20
04-0ct-90	200.0	-	198,000 mg/L	99.00
04-0ct-90		mu/L	49,600 mg/L	99.20
94-0ct-90		Hg/L	53.500 mg/L	107.00
04-0ct-90		mg/L	49.100 mg/L	98.20
Type of Control Sample: Laboratory Control Sa	imple.			
26-\$ep-90	10,0	mg/L	9.560 mg/L	95.60
26-Sep-90	15700.0	-	15500.000 mg/Kg	98.73
28-\$- 0-9 0	15700.0	mg/Kg	14800.000 mg/kg	94.27
28-Sep-90	10.0	mg/L	8.550 mg/L	85.50
03-0ct-90	15700.0	mg/L	11900.000 mg/L	75.80
03-0ct-90	10.0	mg/L	10.100 mg/L	101.00
Number of Samples = 51	Hean X Reco	very #	97.9 CY (%) =	4.3
Method: ICP Metals by SW6010				
Metrix: TREATED				
inalyte: Lead				
ype of Control Sample: Calibration Control S.	ampie.			
4-\$ ep-90	5,000	mg/L	4.950 mg/L	99.00
4-Sep-90	5.000	mg/L	4.920 mg/L	95.40
- 16h. 10		-	5.090 mg/L	101 80
	5.000	ang/L		101.80
4-3ep-90 4-5ep-90 4-5ep-90			9.990 mg/L	99.90
4-Sep-90	5.000	mq/L		
4-Sep-90 4-Sep-90 9-Sep-90	5.000 10.0	mg/L ma/L	9.990 mg/L	99.90
4-Sep-90 4-Sep-90 9-Sep-90 9-Sep-90	5.000 10.0 5.000	mq/L mq/L mg/L	9.990 mg/L 5.480 mg/L	99.90 109.60 99.90
4-Sep-90 4-Sep-90 9-Sep-90 9-Sep-90 9-Sep-90	5.000 10.0 5.000 10.0	mg/L mg/L mg/L	9.990 mg/L 5.480 mg/L 9.990 mg/L	99.90 109.60
4-Sep-90 4-Sep-90 7-Sep-90 7-Sep-90 7-Sep-90 7-Sep-90	5.000 10.0 5.000 10.0 5.000	mg/L mg/L mg/L mg/L	9.990 mg/L 5.480 mg/L 9.990 mg/L 5.410 mg/L	99.90 109.60 99.90 108.20
4-5ep-90 4-5ep-90	5.000 10.0 5.000 10.0 5.000 5.000	mg/L mg/L mg/L mg/L mg/L	9.990 mg/L 5.480 mg/L 9.990 mg/L 5.410 mg/L 5.490 mg/L	99.90 109.60 99.90 108.20 109.80

Table F4 (Continued)

***************************************	True		Det Flag	Reasured Value	% Recovery
Date	Value		7149	70,00	
lethod: ICP Metals by SW6010					
latrix: TREATED					
matyte: Lead		4			
ype of Control Sample: Calibration Control Sample	. continued	,			
	* 000	mg/L		5.380 mg/L	107.60
\$-\$ep-90	••••	•		9.990 mg/L	97.90
19-Sep-90 .	. 10.0	mg/L		10.100 mg/Kg	101.00
26-5 ep-90	10.0	mg/Kg		5.450 mg/L	109.00
26-Sep-90	5.000	mg/L		5,290 mg/L	105.80
26-Sep-90	5.000	mg/L		5.440 mg/L	108.80
26-5 ep-9 0	5.000	mg/L		5.460 mg/L	109.20
26-Sep-90	5.000	mg/L	•	5.100 mg/l	102.00
28-Sep-90	5.000	mg/L		5,310 mg/l	106.20
28-5ep-90	5.000	mg/L		4,990 mg/l	99.80
28-Sep-90	5.000	mg/L		4.820 mg/l	96.40
01-0ct-90	5.000	mg/L		4.740 mg/l	94.80
01-0ct-90	5.000	mg/L		4.820 mg/t	96.40
01-0c1-90	5.000	mg/L			101.00
01-0ct-90	10.0	mg/L		10.100 mg/l	94,40
03-0ct-90	5.000	mg/L		4.720 mg/L	93.00
03-0ct-90	5.000	mg/L		4.650 mg/L	95.40
03-0ct-90	5.000	mg/L		4,770 mg/L	99.33
03-0ct-90	10.0			9.930 mg/l	95.60
03-0ct-90	5.000	mg/L		4.750 mg/L	95.00
03-0ct-90	5.000	mg/L		4.750 mg/L	94.20
03-0ct-90	5.000	mg/L		4.710 mg/L	100.00
03-0ct-90	10.0	mg/L		10.000 mg/L	
03-0ct-90	5.000	mg/L		4.720 mg/l	94.40
03-Oct-90	10.0	mg/L		9.750 m/g/1	
03-0ct-90	5.000	mg/L		5.170 mm/l	103.40
03-Oct-90	5.000	mg/L		5.080 mg/l	101.60
03-0ct-90	5.000	mg/L		5.150 mg/l	103.00
04-0ct-90	10.0	mg/L		9,890 mg/L	98.90
04-0ct-90	5,000	mg/L		5.340 mg/L	106.80
04-0ct-90	5.000	mg/L		5,490 mg/L	109.80
04-0ct-90	5,000	mg/L		5.200 mg/L	104.00
Type of Contru' Sample: Laboratory Control Sample	: .				
24.5	1.000	mg/L		0.908 mg/L	
26-Sep-90	117.0	mg/Kg		116.000 mg/K	
26-Seo-90	1.000	mç/L		0.873 mg/l	87.30
28-5ep-90		mg/KG		108,000 mg/k	a 92.31

Table F4 (Continued)

		True	Det	Heasured	x
Date		Value	flag	Value	Recovery
ethod: ICP X	etals by SU6010				
atrix: TREATE	ED			•	
inelyte: Lead					
ype of Contro	ol Sumple: Laboratory Control S.	Amole, continued			
3-0ct-90		117.0 mg/L		123.900 mg/L	105.13
3-0ct-90		1.000 mg/L		1.050 mg/L	105.00
3-0ct-90		0.500 mg/L		0.477 mg/L	95.40
	Number of Samples = 49	≓ean % Recovery → 10	01.0	CV (%) =	5.7
ethod: ICP Me	tals by SH6010				
atrix: TREATE	D				
nelyte: Hicke	t				
ype of Contro	l Sample: Calibration Control S	ample.			
4-s ep- 90		5.000 mg/L		4.930 mg/L	98.60
4-5ep-90		5.000 mg/L		5.040 mg/L	100.80
6-Sep-90		10.0 mg/L		10.100 mg/L	100.00
6-Sep-90		5.000 mg/t		4.950 mg/L	99.00
7-Sep-90		5.000 mg/t		5.270 mg/L	105.40
7-Sep-90		10.0 mg/L		10.000 mg/L	100.00
7- Sep-90		5.000 mg/L		5.350 mg/L	197.00
7-Sep-90		5.000 mg/L		5.330 mg/L	106.60
7-5ep-90		5.300 mg/L		5.430 mg/L	108.60
7-5ep-90		5.000 #a/L		5.430 mg/L	108.60
- Sep-90		10.0 mg/L		10.000 mg/L	100.00
-5ep-90		5.000 mg/L		5.330 mg/L	107.60
-5ep-90		5.000 mg/L		5.350 mg/L	107.00
-Seo-90		5.000 mg/L		5.440 mg/L	108.80
-Sep-90 -Sep-90		5,000 mg/L		5.410 mg/L	108.20
- S ep- 9 0 - Sep- 90		5.000 mg/L		5.430 mg/L	108.60
- Sep-90		10.0 mg/L		10.200 mg/L	102.00
		5,000 mg/L		5.340 mg/L	106.80
. C OC		5.000 mg/L		5.460 mg/L	109.20
-		5.000 mg/L		4.870 mg/l	97.40
· 5ep-90				9.980 mg/L	99.80
-5ep-90 -5eb-90		10.0 mg/t_			
-5ep-90 -5ep-90 -5ep-90		5.000 mg/L		5.170 mg/t	103.40
-5ep-90 -5ep-90 -5ep-90 -5ep-90		5.000 mg/L 5.000 mg/L		5.170 mg/t 5.150 mg/t	103.40 103.00
-5ep-90 -5ep-90 -5ep-90 -5ep-90 -5ep-90 -0ct-90 -0ct-90		5.000 mg/L		5.170 mg/t	103.40

Table F4 (Continued)

	True	1	Det Measure	ed .	X
Date	Value	1	Flag Value		Recovery
Method: ICP Metals by SW6010					
Matrix: TREATED					
ınalyte: Nickel					
ype of Control Sample: Calibratio	n Control Sample, continue	d			
11-0ct-90	5,000	mg/L	4.700	mg/l	94.00
11-0ct-90	5.000	mg/L	4.740	mg/l	94.80
3-0ct-90	5.000	mg/L	4.830	mg/L	96.60
3-0ct-90	5.000	ng/L	4.810	mg/L	96.20
3-0ct-90	10.0	ang/L	9.890	mg/L	98.90
3-0ct-90	5.000	mg/L	4.860	mg/L	97.20
3-0ct-90	5.000	mg/L	4.850	mg/L	97.00
3-0ct-90	5,600	mg/L	4.800	mg/L	96.00
3-0ct-90	5.000	mg/L	4.760	mg/L	95.20
3-0ct-90	10.0	mg/L	10.000	mg/L	100.00
4-0ct-90	5.000	mg/L	5.460	mg/L	109.20
4+0ct-90	5.000	mg/L	5.270	mg/L	105.40
4-0ct-90	5.000	mg/L	5.200	mg/L	104.00
4-Oct-90	10.0	mg/L	9.830	mg/L	98.30
ype of Control Sample: Laboratory	Control Sample.				
6-Sep-90	1.000	mg/L	0.927	mg/L	92.70
6-Sep-90	225.0	mg/Kg	194.000	mg/Kg	86.22
8-\$ ep-9 0	1.000	mg/L	0.850	mg/l	85.00
8-3 ep-9 0	225.0	mg/Kg	170.000	mg/kg	75.56
1-0ct-90	0.300	mg/L	0.487	mg/l	97.56
3-0at-90	225.0	mg/L	216.000	img/L	96.00
3-0ct-90	1.000	mg/L	1.020	mg/L	102.00

Table F4 (Continued)

Date		True Det Value Flag	Heasured Value	% Recovery
Method: ICP Metal	ls by SW6010			
Matrix: TREATED				
Anmlyte: Silver				
Type of Control S	Sample: Calibration Control:	Sample.		
04-Sep-90		10.0 mg/L	9.950 mg/L	99.50
04-Sep-90		5.000 mg/L	5.000 mg/L	100.00
04-5 ep- 90		5.000 mg/L	5.110 mg/L	102.20
34-Seo-90		5.000 mg/L	4.910 mg/L	98.20
13-0ct-90		5.000 mg/L	4.820 mg/L	96.40
3-0ct-90		5.000 mg/L	4.840 mg/l	96.80
03-0ct-90		10.0 mg/L	9.790 mg/l	97.90
3-0ct-90		5.000 mg/L	4.740 mg/l	94.80
3-0ct-90		5.000 mg/L	4.740 mg/l	94.80
13-0ct-90		1.000 mg/L	0.997 mg/l	99.70
03-0ct-90	Mumber of Samples = 10	1.000 mg/L Hean % Recovery = 98.0		99.70
			CV (X) =	2.4
	***************************************	Hean % Recovery = 98.0	CV (X) =	2.4
*********	***************************************	Hean % Recovery = 98.0	CV (X) =	2.4
lethod: pil by SV9	***************************************	Hean % Recovery = 98.0	CV (X) =	2.4
lethod: pH by SV9 letrix: TREATED unallyte: pH	***************************************	Mean I Recovery = 98.0	CV (X) =	2.4
lethod: pH by SV9 letrix: TREATED unallyte: pH	***************************************	Mean I Recovery = 98.0	CV (X) =	2.4
lethod: pH by SW9 letrix: TREATED unalyte: pH ype of Control S	***************************************	Hean % Recovery = 98.0	CV (X) =	2.4
lethod: pH by SW9 letrix: TREATED unalyte: pH lype of Control S 9-Sep-90	***************************************	Hean % Recovery = 98.0	CV (X) =	101.41
Hethod: pH by SW9 Hatrix: TREATED Unallyte: pH Type of Control S 9-Sep-90 9-Sep-90	***************************************	Hean % Recovery = 98.0 Tample. 7.000 pH units 7.000 pH units	7.099 pH units 7.093 pH units	101.41
Hethod: pH by SW9 Hatrix: TREATED Unallyte: pH Type of Control S 9-Sep-90 9-Sep-90	exple: Calibration Control S	Hean X Recovery = 98.0 Tample. 7.000 pH units 7.000 pH units 7.000 pH units 7.000 pH units	7.099 pH units 7.093 pH units 7.003 pH units	101.41 101.33 100.04
Hethod: pH by SW9 Hatrix: TREATED Unallyte: pH Type of Control S 9-Sep-90 9-Sep-90	Number of Samples = 3	Hean X Recovery = 98.0 Tample. 7.000 pH units 7.000 pH units 7.000 pH units 7.000 pH units	7.099 pH units 7.093 pH units 7.003 pH units	101.41 101.33 100.04

Table F4 (Continued)

使对抗原理检查性法国用证明不被 使用法国际企业。 计数据显示线电影或是对数据过程电影系统	True Yalue	Det	Heasured Value	% Recovery
Date	74108			
ethod: Selenium by AA (E270-2)				
etrix: Solid				
nelyte: Selenius				
ype of Control Sample: Calibration Contro	i Sampie.			
₹ 1 M	9.050 mg/L		0.048 mg/L	96.00
7-Aug-90	0.050 mg/L		0.050 mg/L	100.00
7-Aug-90	0.050 mg/L		0.047 mg/L	94.00
5-Sep-90	0.050 mg/L		0.047 mg/l.	94.00
5-sep-90 5-sep-90	0.050 mg/L		0.050 mg/L	100.00
			CH (X) =	3.1
Number of Samples = 5	Hean & Recovery	96.8	CA (A) =	
Number of Samples = 5	Hean X Recovery	8,86	- (A) HJ Redesersesses	*******
Number of Samples = 5	Heen X Recovery	. 96.8 *********	- (2) HJ	****
Number of Samples = 5	Heen X Recovery	: 96.8 ::::::::::::::::::::::::::::::::::::	。(《文) H.J.	*********
ethod: Selenium by AA (E270.2)	Heen X Recovery	: 96.8 ::::::::::::::::::::::::::::::::::::	- (A) HJ	**********
**************************************	Heen X Recovery	***************************************	- (A) -	· 经现金股份 化二甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基
Tethod: Selenium by AA (E270.2)	******************	* 96.8		***********
Type of Control Sample: Calibration Control	******************	. 96.8	0.047 mg/L	94.00
tethod: Selenium by AA (E270.2) (atrix: TREATED Longlyte: Selenium Type of Control Sample: Calibration Control 05-Sep-90	ol Sample.	6,6 0 :	***************************************	94.00 94.00
tethod: Selenium by AA (E270.2) (atrix: TREATED Inalyte: Selenium Type of Control Sample: Calibration Control 05-Sep-90 05-Sep-90	ol Sample.	*********	0.047 mg/L	94.00 94.00
tethod: Selenium by AA (E270.2) (atrix: TREATED Inalyte: Selenium Type of Control Sample: Calibration Control 05-Sep-90 05-Sep-90 05-Sep-90	ol Sample. 0.050 mg/L 0.050 mg/L	***************************************	0.047 mg/L 0.047 mg/L	94.00 94.00
tethod: Selenium by AA (E270.2) (atrix: TREATED Inalyte: Selenium Type of Control Sample: Calibration Control 05-Sep-90 05-Sep-90	ol Sample. 0.050 mg/L 0.050 mg/L 0.050 mg/L	***************************************	0.047 mg/L 0.050 mg/L	94.00 94.00 100.00 94.20
tethod: Selenium by AA (E270.2) (atrix: TREATED Inalyte: Selenium Type of Control Sample: Calibration Control 05-Sep-90 05-Sep-90 16-Oct-90	0.050 mg/L 0.050 mg/L 0.050 mg/L 0.050 mg/L 0.050 mg/L	***************************************	0.047 mg/L 0.047 mg/L 0.050 mg/L 0.057 mg/L	94.00 94.00 100.00 94.20
dethod: Selenium by AA (E270.2) Hatrix: TREATED Louiste: Selenium Type of Control Sample: Calibration Control 05-Sep-90 05-Sep-90 16-0ct-90 16-0ct-90	0.050 mg/L 0.050 mg/L 0.050 mg/L 0.050 mg/L 0.050 mg/L	***************************************	0.047 mg/L 0.047 mg/L 0.050 mg/L 0.057 mg/L	94.00 94.00 100.00 94.20

Table F4 (Continued)

	True	Det M	essured	_
Date	Value	Flag	Value	Recover
ethod: Chrome VI by SW7196				
etrix: Solid				
nelyte: Chromium VI				
ype of Control Sample: Calibration Control S	iampie.			
6-Jul-90	. 0.500 mg/	L	0.490 mg/L	98,00
2-Jul-90	0.300 mg/		0.300 mg/L	100.00
6-Jul-90	0.400 mg/	L	0.390 mg/L	97.50
6-Jul-90	0.400 mg/		0.400 mg/L	100.00
ype of Control Sample: Laboratory Control Sa	imple.			
5-Hay-90	0.300 mg/	.	0.322 mg/L	107.33
5-Nay-90	0.300 mg/	L	0.312 mg/L	106.67
5-Hay-90	0.300 mg/	L	0.320 mg/L	106.67
6-May-90	0.800 mg/	L	0.786 mg/L	98.25
6-May-90	0.800 mg/	L	0.793 mg/L	99.13
6-May-90	0.300 mg/	L	0.287 mg/L	95.67
6-May-90	0.300 mg/		0.289 mg/L	96.33
6-May-90	0.300 mg/		0.239 mg/L	96.33
6-Hey-90	0.300 mg/1		0.278 mg/L	92.67 97.33
6-May-90	0.300 mg/s		0.252 mg/L 0.254 mg/L	94.67
6-May-90 6-May-90	0.300 mg/1		0.300 mg/L	100.00
6-May-90	0.200 mg/l		0.200 mg/L	100.00
7-May-90	0.300 mg/		0.299 mg/L	96.67
7-May-90	0.200 mg/		0.190 mg/L	95.00
7-May-90	0.300 mg/l		0.290 mg/L	96.67
7-May-90	0.300 mg/1		0.301 mg/L	96.67
7-May-90	0.300 mg/s	•	0.290 mg/L	96.67
7-Hay-90	0.300 mg/l	•	0.290 mg/L	96.67
7-Hay-90	0.300 mg/1	•	0.290 mg/L	96.67
7-Hey-90	0.300 mg/s	-	0.290 mg/L	96.67
5-May-90	0.300 mg/1	•	0.296 mg/L	90.67
3-⊭ay-90	0.300 mg/t		0.292 mg/L	97.33
3-Hey-90	0.300 mg/s		0.284 mg/L	95.33
3-Hay-90	0.300 mg/l		0.286 mg/L	95.33
2-May-90	0.300 mg/s		0.292 mg/L	97.33
3-May-90	0.300 ₩g/1	_	0.294 mg/L	98.00

Table F4 (Continued)

Date	True Value	Det Flag	Measured Value	Recovery
Method: Chrome VI by SW7196				
terrix: Solid				
Inelyze: Chromium VI				
Type of Control Sample: Laboratory Co	ntrol Sample, continued			
**************************			***********	*********
ethod: Chrome VI by SW7196				
Atrix: TREATED				
nelyte: Chromium VI				
ype of Control Sample: Calibration Co	ontrol Sample.			
3-Aug-90	0.500 mg	/L	0.511 mg/L	102.20
3-Aug-90	0.500 mg		0.512 mg/L	102.40
3-Aug-90	0.500 mg	•	0.485 mg/L	97.00
5-Aug-90	0.500 mg	-	0.493 mg/L	99.60
I-S ep-9 0	0.500 mg	-	0.503 mg/L	100.60
)-Sep-90	0.500 mg		0.500 mg/L	100.06
1-S ep-9 0	0.800 mg		0.840 mg/L	105.00
1-Sep-90	0.800 mg		0.820 mg/L	102.50
1-Sep-90	0.300 mg		0.800 mg/L	100.00
?-Sep-90	0.800 mg		0.830 mg/t	
?-Sep-90	0.200 mg		0.210 mg/t	103.75
?-Sep-90	0.800 mg		-	105.00
?-\$ep-90	0.800 mg		0.810 mg/L	101.25
-\$ ep-9 0	0.500 mg		0.840 mg/L	105.00
r\$ep-90	0.500 mg		0.519 mg/L	103.80
-\$ ep-90	0.500 mg		0.520 mg/L	104.00
-Sep-90	0.500 mg/		0.523 mg/L	104.60
-3ep-90	0.500 mg/		0.495 mg/t	99,00
-Sep-90	0.500 mg/		0.495 89/1	99,20
-\$ep-90	· · · · · · · · · · · · · · · · · · ·		0.497 mg/l	99,40
-Sep-90	·		0.820 mg/t	102,50
-Sep-90	••		0.200 mg/L	100,00
-Sep-90	0.500 mg/		0.506 mg/L	101.10
· Sep- 90			0.507 mg/L	101.36
:Sep-90	0.500 mg/		0.508 mg/L	101.62
· Sep-90	0.500 mg/		0.510 mg/L	102,04
· Sep- 90	0.500 mg/	-	0.510 mg/t	102.04
Sep-90	0.500 mg/		0.517 mg/l	103,46
	0.500 mg/	L	0.510 mg/t	102.04
Sep-90	0.500 mg/		0.519 mg/t	103.86

Table F4 (Continued)

Date		7		Manager	ĭ
		True Value	Det Flag	Mensured Value	Recovery
					
Method: Chrome VI	by \$47196				
Matrix: TREATED					
Analyte: Chromium	• •				
rype of Control S.	ample: Calibration Control S	ample, continued			
9-Sep-90		0.500 mg/L		0.525 mg/L	105.00
	Number of Samples = 31	Hean % Recovery =	102.1	CV (X) =	2.1
· 法制理资本的基本证明的	*****************	**************	*******	**********	**********
lethod: Sulfate by	y IC (E300.0)				
Matrix: Solid					
inalyte: Sulfate					
ype of Control Sa	emple: Calibration Control S	amie.			
0-Jul-90		40.0 mg/L		38.940 mg/L	97.35
0-Jul-90		40.0 mg/L		39.040 mg/L	97.60
4-Sep-90		40.0 mg/L		39.890 mg/L	99.73
				38.520 mg/L	97.05
4-Sep-90		40.0 mg/L			
		40.0 mg/L		38.720 mg/L	96.80
	Number of Samples = 5		97.7	-	96.80
	Number of Samples = 5	40.0 mg/L	97.7	38.720 mg/L	
14-Sep-90 14-Sep-90 14-Sep-90 14-Sep-90 14-Sep-90	*****************	40.0 mg/L	97.7	38.720 mg/L	
4-Sep-90 ethod: Sulfate by atrix: TREATED	*****************	40.0 mg/L	97.7	38.720 mg/L	
4-Sep-90	*****************	40.0 mg/L	97.7	38.720 mg/L	
ethod: Sulfate by atrix: TREATED malyte: Sulfate	*****************	40.0 mg/L Mean X Recovery =	97.7	38.720 mg/L	
ethod: Sulfate by atrix: TREATED nelyte: Sulfate ype of Control Sa	· IC (E300.0)	40.0 mg/L Mean X Recovery =	97.7	38.720 mg/L	
ethod: Sulfate by atrix: TREATED malyte: Sulfate upe of Control Sa	· IC (E300.0)	40.0 mg/L Mean X Recovery =	97.7	38.720 mg/L CV (%) =	1.2
ethod: Sulfate by atrix: TREATED nelyte: Sulfate ype of Control Sa 4-Sep-90	· IC (E300.0)	40.0 mg/L Mean X Recovery = smole. 40.0 mg/L	97.7	38.720 mg/L CV (\(\lambda\) =	97.05
ethod: Sulfate by atrix: TREATED nelyte: Sulfate upe of Control Sa i-Sep-90 i-Sep-90 i-Sep-90	· IC (E300.0)	### ##################################	97.7	38.720 mg/L CV (\(\bar{\chi}\) = 38.820 mg/L 39.890 mg/L	97.05 99.73
ethod: Sulfate by atrix: TREATED nelyte: Sulfate upe of Control Sa i-Sep-90 i-Sep-90 i-Sep-90 i-Sep-90	· IC (E300.0)	40.0 mg/L Hean X Recovery = smole. 40.0 mg/L 40.0 mg/L 40.0 mg/L	97.7	38.720 mg/L CV (\(\lambda\) = 38.820 mg/L 39.890 mg/L 38.720 mg/L	97.05 99.73 96.80
ethod: Sulfate by atrix: TREATED malyte: Sulfate upe of Control Sa i-Sep-90 i-Sep-90 i-Sep-90 i-Sep-90 i-Sep-90	· IC (E300.0)	40.0 mg/L Hean X Recovery = ample. 40.0 mg/L 40.0 mg/L 40.0 mg/L 40.0 mg/L	97.7	38.720 mg/L CV (\(\lambda\) = 38.820 mg/L 39.890 mg/L 38.720 mg/L 38.820 mg/L	97.05 99.73 96.80 97.05
ethod: Sulfate by atrix: TREATED nelyte: Sulfate ype of Control Sa 6-Sep-90 6-Sep-90 6-Sep-90 6-Sep-90 6-Sep-90 6-Sep-90 6-Sep-90 6-Sep-90 6-Sep-90	· IC (E300.0)	40.0 mg/L Hean X Recovery = ample. 40.0 mg/L 40.0 mg/L 40.0 mg/L 40.0 mg/L 40.0 mg/L 40.0 mg/L	97.7	38.720 mg/L CV (\(\bar{\chi}\) = 38.820 mg/L 39.890 mg/L 38.720 mg/L 38.820 mg/L 38.820 mg/L	97.05 99.73 96.80 97.05 95.80
ethod: Sulfate by atrix: TREATED malyte: Sulfate	· IC (E300.0)	40.0 mg/L Mean X Recovery # ample. 40.0 mg/L 40.0 mg/L 40.0 mg/L 40.0 mg/L 40.0 mg/L 40.0 mg/L	97.7	38.720 mg/L CV (\(\bar{\chi}\) = 38.820 mg/L 39.890 mg/L 38.720 mg/L 38.820 mg/L 38.720 mg/L 38.720 mg/L	97.05 99.73 96.80 97.05 95.80 96.80
ethod: Sulfate by atrix: TREATED nelyte: Sulfate ype of Control Sa i-Sep-90 i-Sep-90 i-Sep-90 i-Sep-90 i-Sep-90 i-Sep-90 i-Sep-90 i-Sep-90	· IC (E300.0)	40.0 mg/L Mean X Recovery # ample. 40.0 mg/L 40.0 mg/L 40.0 mg/L 40.0 mg/L 40.0 mg/L 40.0 mg/L 40.0 mg/L	97.7	38.720 mg/L CV (1) = 38.820 mg/L 39.890 mg/L 38.720 mg/L 38.720 mg/L 38.720 mg/L 38.720 mg/L 38.720 mg/L	97.05 99.73 96.80 97.05 96.80 97.05

Table F4 (Concluded)

Date	True Value	· Det Flag	Heasured Value	Recovery
Method: Sulfate by IC (E300.0)				
Matrix: TREATED				
Analyte: Sulfate				
Type of Control Sample: Calibration	Control Sample, continued			
?8-S ep-9 0	40.0 mg/L		40.370 mg/L	100.93
•	40.0 m g/L 40.0 m g/L		40.370 mg/L 37.670 mg/l	100.93 94.18
3-0ct-90				
28-5ep-90 03-0ct-90 03-0ct-90 03-0ct-90	40.0 mg/L		37.670 mg/l	94.18
13-0ct- 9 0 13-0ct- 9 0	40.0 mg/L 40.0 mg/L		37.670 mg/l 37.624 mg/l	94.18 94.06

Table F5 Surmary of Spike Results, Frontier Hard Chrome

SUPPLARY OF SPIKE RESULTS FOR MATRIX * MJ EP LEACHATE; SUDMATRIX * N/A

				- 杂级对达 机催热物 预装的 化氯苯酚	P. 机机械 化苯酚苯酚苯酚苯酚 医甲基基氏		
	Mumber	Number			Number Below	Number Below Number Above	(Matrix)
Paraneter	of Samples	of of Mean X Samples Recoveries Recovery	Hean K Recovery	Standard Deviation	Acceptance Limits	Acceptance Limits	Acceptance Criteria
ICP Metals by Su6010							
Hethod Spike (Into Blank)							
Chronica	-	_	106.0		0	c	0 34 0 54
Iron	_		104.0				0.00
matrix spike			2		•	5	0.621 - 0.67
Chromica	4	•	103.8	7.50000	0	0	75.0 - 125.0
Iron	•	•	107.5	13.17963	•	-	75.0 - 125.0
Lead	•	4	97.9	2.92347	0	0	75.0 • 125.0
Nickel	•	,	8.8	.06603	0	0	75.0 - 125.0

Statistics calculated only for samples with a valid recovery.

(Continued)

(Continued)

Table F5 (Continued)

SUPPLIENCE RESULTS FOR MATRIX = Solid; Submatrix = I Number Mumber Mumber Mumber Mean X Standard Acceptance Acceptance Acceptance of Mean X Standard Acceptance Acceptance Criteria Parameter Samples Recoveries Recovery Deviation Limits Limits Criteria	M. M.	SUPPLARY OF SPIKE RESULTS FOR MATRIX = Solid; Sudmatrix = I Number Number of of Parameter Samples Recoveries
--	-------	---

Arsenic by AA (E206.2) Predigestion Hatrix Spike Arsenic	-	-	0.96		0	9	75.0 - 125.0
ICP Metals by Su6010 Method Spike (Into Blank) Bartum Cachnium Chromium Iron Lead Wickel Silver matrix spike Chromium Iron Lead Wickel			95.9 92.9 96.5 98.7 101.0 91.0 97.2 97.2 97.3	3.17657 .84653 1.50444 1.41421 .95743 2.57610 1.37204	000000 0000		75.0 - 125.0 75.0 - 125.0
Setentum by AA (E270.2) predigestion Metrix Spike Setentum	-	-	96.0		o	•	, 75.0 - 125.0
Chrome VI by Su7196 matrix spike Chromium VI	•	•	100.3	7.21688	•	o	75.0 - 125.0

Statistics calculated only for samples with a valid recovery.

(Continued)

Statistics calculated only for samples with a valid recovery.

Table F5 (Continued)

SLPGARY OF SPIKE RESULTS FOR MATRIX = Solid; Subratrix = W/A

	Kurber	Humber			Mumber Below	Mumber Above	r Above (Metrix)
	jo	Jo	Hean X	Standard	Acceptance	Acceptance	Acceptance
Parameter	Samples	Recoveries Recovery	Recovery	Deviation	Limits	Limite	Criteria
Chloride by 1C (£300.0)							
matrix spile							
Chloride	•	4	11.3	6.81845	7	0	80.0 - 120.0
ICP Metals by SU6010							
Method Spike (Into Blank)							
Chromium	n	×	101.7	6.65833	0	9	75.0 - 125.0
11.00	•	m	100.6	4.40492	0	0	75.0 - 125.0
lead	~	m	100.2	8.24379	0	0	75.0 - 125.0
Mickel	~	~	97.9	7.28323	0	0	75.0 - 125.0
metrix spike							
Chrosium	75	28	106.1	48.83872	49	5	75.0 - 125.0
17.0	5	^	71.7	33.33179	27	0	75.0 - 125.0
Pead	36	31	107.1	79.25467	71	J	75.0 - 125.0
wicke!	58	57	98.9	11.90955	n	-	75.0 - 125.0
Chrome VI by SW7196							
metrix spike							
Chronium VI	10	2	97.1	9.76557	0	0	75.0 - 125.0
Sulfate by 1C (£300.0)							
setrix spike							
Sulfate	•	•	8.49	7.98114	0	0	80.0 - 120.0

Table F5 (Continued)

	*************	***********		医球球球球球球球球球球球球球球球球球球球球球球球球球球球球球球球球球球球球球	神经 化冷水管 医阴道性 医阴道性 计计算	•	14 医骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨骨
	Muncher	Number Number			Mumber Below	Mumber Below Mumber Above	(MELLEX)
	10	o	Hean X		Acceptance A	Acceptance	Acceptance
Parantic	Samples	Recoveries	Samples Recoveries Recovery	Devistion	Limits	Limite	

ICP Metals by \$46010							
Action spire time are		•	97.2	3.48186	0	0	75.0 - 125.0
Cironium	,	^	97.1	1.41421	0	0	75.0 - 125.0
Loo	. ^	. ^	8.96	3.95980	•	0	75.0 - 125.0
	۰ ۲	. ~	97.6	3.46482	0	0	75.0 - 125.0
mitkei matrix spike		4	92.9	2.49583	0	0	75.0 - 125.0
Chronium	•	•					
Chrome VI by \$u7196							
matrix spike	•		y 74	17, 15089	•	0	75.0 - 125.0
Chronium VI	10	٥	3		Ì		
Predigestion Matrix Spike		·	,		c	0	75.0 - 125.0
Chronium VI	-	-	3 00.3		,	ŀ	

Statistics calculated only for samples with a valid recovery.

Continued)

Statistics calculated only for samples with a valid recovery.

Table F5 (Continued)
SUMMARY OF SPIKE RESULTS FOR MAIRIX = TREATED; SUMMARIN = T

Standard		Mumber Below	Number Above	(Matrix)
Contract of the second sections of Contract of Contrac	* u	Acceptance	Acceptance	Acceptance
The same of the sa	Recovery Deviation	Limits	Limits	Criteria

ICP Metals by SU6010							
Method Spike (Into Blank)							
Bar tun	-	_	96.3		0		75.0 - 125.0
Caranica	-	_	98.7		0	0	75.0 - 125.0
Chronium	~	•	8.2	3,43948	0	0	75.0 - 125.0
2	~	~	96.3	4.65224	0	0	75.0 - 125.0
Lead	-	~	8.8	5.83809	0	0	75.0 - 125.0
Mickel	~	~	0.8	3.55012	0	9	73.0 - 125.0
Silver	-	_	93.9		0	0.	75.0 - 125.0
matrix spike							
Chromium	~	7	89.0	21.21320	_	0	75.0 - 125.0
Iron	~	~	90.0	14.14214	0	0	75.0 - 125.0
read.	~	7	89.0	1.41421	0	0	75.0 - 125.0
Mickel	~	~	85.4	.70711	0	0	75.0 - 125.0
Chrome VI by SU7196 matrix spike							
Chronium VI	4 3	40	0.8	5,59819	c	c	6 AC

Table F5 (Continued)

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TREATED; Submatrix
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OF SPIKE RESULTS FOR MATRIX
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SUPPLARY
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Persontter	Number of Samples	Number of Recoveries	Hean X Recovery	Standard Deviation	Number Below Acceptance Limits	Number Above Acceptance Limits	(Matrix) Acceptance Criteria
Arsenic by AA (£206.2)							
Rethod Spike (Into Blank)	^	^	0.00	00000	o	•	73.0 - 125.0
71.5cm		,	:		•	,	
Chloride by IC (E300.0)							
matrix spike					,	,	
Chloride	•	√ 0	97.2	4.93892	•	•	0.021 - 0.03
Hercury by Cold Vapor AA (F245.1)							
Method Spike (Into Blank)							
Mercury	-	-	7.79		0	•	75.0 - 125.0
ICP Metals by Su6010							
Method Spike (Into Blank)							
Chronius	-	-	65.6		•	0	75.0 - 125.0
81	-	-	85.5		•	0	75.0 - 125.0
pear	~	~	8.06	4.87904	0	0	75.0 - 125.0
Wickel	~	2	91.3	8.90958	•	•	75.0 - 125.0
matrix spike							;
Chronium	•	4	- 217.0	348.25096	~	0	75.0 - 125.0
Lou	~	4	-4183.9	4932.7030	~	0	75.0 - 125.0
Lead	~	~	\$0.5	75.24.788	-		75.0 - 125.0
Rickel	•	•	97.79	3.59762	0	0	75.0 - 125.0
Selenium by AA (£270.2)							
Hethod Spike (Into Blank)							
Selenium	n	n	392.3	506.22072	0		N.0 - 125.0

Statistics calculated only for samples with a valid recovery.

Table F5 (Concluded)

SUPCARY OF SPIKE RESULTS FOR MATRIX " TREATED; Submatrix " M/A

	A STATE OF THE PARTY OF THE PAR	in the same				1	
	to	5	Heen X	Stenderd	Acceptance	RESOCT BOLOW HUMBER ABOVE Acceptance Acceptance	(Matrix)
Parameter	Semples	Samples Recoveries Recovery	Recovery	Deviation	Lieite	Limite	Criteria
Chrone VI by Su7196							
Analytical							
Chromium VI	•	•	54.7	42.38677	~	6	7 5 1 - 1 X
Hethod Spike (Into Blank)					ļ	•	
Chronium VI	-	-	97.7		0	0	75.0 - 125.0
satrix spike						•	
Chroatum VI	•		0.		~	•	7.0 . 125.0
Predigestion Matrix Spike					1	,	
Chronium VI	-	-	100.0		0	0	75.0 - 125.0
Sulfate by IC (£300.0)							
Analytical							
Sulfate	-	-	98.1		0	-	0.
matrix spike							
Sulfate	•		104.4	8.81752	•	6	Rt 0 . 120 0

Statistics calculated only for amples with a valid recovery.

Table F6

Detailed Listing of Matrix Spike Results, Frontier Hard Chrome

					Spiked			
				Sample	Sample	Spike		X.
Date	Lab ID	Lab Fraction	Flag	Result	Result	Added		Recovery
dethod: A	senic by	AA (E206.2)						
	olid Subme							
Spiked And	ilyte: Ari	senic						
Type of S;	oik e = Pre	digestion Hatrix Spik	e .					
27-Aug-90	9008041	00		0.00 mg/L	0.048 mg/L	0.050	mg/L	96.0
	Total >	lumber of Spikes = 1			Below acceptance = 0	······································		
	Number	of Samples Used For S	tatistics = 1		Above acceptance # 0			
	Hean X	Recovery = 96			Within acceptance * '			
	Standar	d Deviation ≠			Acceptance Criteria	75.00 -	125.00	
Hethod: Ar	senic by	AA (E206.2)						
Matrix: TR	EATED Sub	omatrix: K/A						
Spiked Ana	lyte: Ars	senic						
)4-Sep-90)6-Sep-90				0.00 mg/Kg 0.00 mg/Kg		0.050		92.00 92.00
	Total k	lumber of Spikes = 2			Below acceptance = 0		·····	
	Number	of Samples Used For S	tatistics = 2	}	Above acceptance = 0			
	Hean X	Recovery = 92			Within acceptance = 2	?		
	Standar	d Deviation = .CO	3		Acceptance Criteria	75.00 -	125.00	
	*********	***************	**********	*************	********************	*******	222222	*********
		(C (E300.0)						
letrix: So Spiked Ana		itrix: H/A .oride						
Type of Sp	ike = mat	rix spike.						
9-Jul-90	9007040	038		143.0 mg/Kg	1213.7 mg/Kg	1273.9	mq/Kg	84.0
9-Jul-90				143.0 mg/Kg		1273.9		82.8
4-5ep-90				248,4 mg/Kg		3500.0		69.6
4-Sep-90				248.4 mg/kg		3500.0	_	74.8
					Below acceptance = 2			
	Total N	umber of Spikes * 4			secon serebraises a C			

Statistics calculated only for samples with a valid recovery, NC: Not Calculable

Table F6 (Continued)

				Sample	Spiked Sample	Spike	x
Date	Lab ID	Lab Fraction	Flag		Result	Added	Recovery
Method: Ch	loride by	IC (E300.0)					
Matrix: So		trix: N/A					
Analyte: C							
Type of Sp	ike: metr	ix spike, continued					
	Hean %	Recovery # 77			Within acceptance =		
	Standar	d Deviation = 6.81			Acceptance Criteria	80.00 - 120.00	
lethod: Ch	loride by	IC (E300.0)					
latrix: TR	EATED SUB	matrix: N/A					
Spiked Ana	lyte: Chl	oride					
lype of Sp	ike = mat	rix spike.					
4-Sep-90	9008399	07A		262.8 mg/Kg	2645.0 mg/Kg	2631.6 mg/Kg	90.5
4-Sep-90	9008399	08A		262.8 mg/Kg	2783.2 mg/Kg	2631.6 mg/Kg	95.7
4-Sep-90	9008204	03A		296.0 mg/Kg	2720.0 mg/Kg	2500.0 mg/Kg	96.9
4-Sep-90	9008204	02A		296.0 mg/Kg	2650.0 mg/Kg	2500.0 mg/Kg	94.1
3-0ct-90	9009103	06A		3678.4 mg/Kg	9044.8 mg/Kg	5268.6 mg/kg	101.8
3-0ct-90	9009103	068		3678.4 mg/Kg	9152.3 mg/Kg	5268.6 mg/Kg	103.9
	Total Hi	mper u/ Spikes * 6	· · · · · · · · · · · · · · · · · · ·		Below acceptance = 0		
	Number (of Samples Used For Sta	tistics = 6		Above acceptance = 0		
	Mean X R	Recovery = 97			Within acceptance = 6	,	
********		d Deviation = 4.93		8. 202222222	Acceptance Criteria	80.00 - 120.00	*********
	, ,	old Vapor AA (E245.1)					
		witrix: N/A					
piked Anai	lyte: Merc	:u ry					
ype of Spi	ke = Meth	od Spike (Into Blank).					
4-Sep-90	9008204	1		0.00 mg /kg	0.488 mg/tg	0.500 mg/Kg	. 97.5
	Total Nu	mber of Spikes = 1			Below acceptance = 0		
	Number o	f Samples Used For Sta	tistics = 1		Above acceptance # 0		
	Mean I R	ecovery = 97			Within acceptance # 1		
	Standard	Devistion =			Acceptance Criteria	75.00 - 125.00	

(Continued)

Statistics calculated only for samples with a valid recovery, NC: Not Calculable

Table F6 (Continued)

				Sample	Spiked Sample	Spike Added		% Recovery
Date	Lab ID	Lab Fraction	Flag	Result	Result	NOCIEG .		ACCOVETY
tetnod: 10	P Metals	by \$40010						
Matrix: M	P LEACH	A/K :xintemdu2 3TA						
Spiked And	lyte: Chr	omium						
Type of Sp	oike = Met	hod Spike (Into Blank	0.					
2- Jul -90	s007047	00		0.00 mg/L	0.212 mg/L	0.200	mg/L	106.0
Type of Sp	ike = mat	rix spike.						
1-Jun-90	\$005159	45A		0.00 mg/L	0.200 mg/L	0.200	mg/L	100.0
31-Jun-90	5005159	450		0.00 mg/L	0.200 mg/L	0.200	mg/L	100.0
18-Jun-90	\$005189	114		1.100 mg/L	1.300 mg/L	0.200	mg/L	100.0
18-Jun-90	\$005189	10A		1,100 mg/L	1.330 mg/L	0.200	mg/L	115.0
		umper of Spikes = 5 of Samples Used For 5	tatistics = 5	<u> </u>	Below acceptance = 0 Above acceptance = 0			
		Recovery = 104			Within acceptance = 5	;		
		d Deviation = 6.5	3 7		Acceptance Criteria		125.00	
Method: IC Metrix: MW Spiked Ana	EP LEACH	ATE Submatrix: N/A						
lype of Sp	ike = Het	hod Spike (Into Blank	o.					
12-Jul-90	s007047	00		0.00 mg/L	1.040 mg/L	1.000	mg/L	104.0
Type of Sp	ike = mat	rix spike.						
11-Jun-90	5005159	454		0.400 mg/L	1,500 mg/L	1.000	mg/L	110.0
11-Jun-90	5005159	450		0.400 mg/L	1.400 mg/L	1.000	mq/L	100.0
8-Jun-90	5005189	10A		0.230 mg/L	1.110 mg/L	1.000	mg/L	88.0
18-Jun-90	5005189	11A		0.230 mg/L	1.500 mg/L	1.000	mg/L	127.0
Z-Jul-90	\$607047	22A		0.059 mg/L	1.120 mg/L	1.000	mg/L	106.1
2-Jul-90	5007047	253		0.059 mg/L	1.200 mg/L	1.000	mg/L	114.1
	Total N	umber of Spikes = 7			Below scceptance = 0			
	Number	of Samples Used for S	tatistics = 7	•	Above acceptance = 1			
	Mean X	Recovery # 107			Within acceptance = 6	,		

Statistics calculated only for samples with a valid recovery. NC: Not Calculable

Table F6 (Continued)

Date	Lab ID	Lab Fraction	Flag	Sample Result	Spiked Sample Resul?	Spike Added	X Recavery
Method: I	P Metals	by \$46010					
Matrix: M	P LEACH	ATE Submetrix: N/A					
Spiked And	ilyte: Les	d					
Type of S	oike = mat	rix spike.					
01-Jun-90	5005159	450		0.00 mg/L	0.500 mg/L	0.500 mg/L	100.0
01-Jun-90	\$005159	45A		0.00 mg/L	0.500 mg/L	0.500 mg/L	100.0
18-Jun-90	\$005189	10A	CH	0.042 mg/L	0.510 mg/L	0.500 mg/t.	97.8
18-Jun-90	\$005189	11A	OK	0.042 mg/L	0.490 mg/L	0.500 mg/L	93.30
	Total N	umber of Spikes = 4			Below acceptance = 0		
	Number	of Samples Used For	Statistics = 4		Above acceptance = 0		
	Mean %	Recovery = 97			Within acceptance # 4		
	Stander	d Deviation = 2	.92		Acceptance Criteria	75.00 - 125.00	
Method: 10	P Metals	by \$46010					
latrix: M	EP LEACH	ATE Submatrix: N/A					
Spiked And	lyte: Nic	kel					
Type of Sp	ike = met	rix spike.					
31-Jun-90	\$005159	45A		0.00 mg/L	0.500 mg/L	0.500 mg/L	100.00
11-Jun-90	\$005159	450		0.00 mg/L	0.500 mg/L	0.500 mg/L	100.00
8-Jun-90	\$005189	114	OM	0.015 mg/L	0.500 m/C	0.500 mg/L /	98.50
8-Jun-90	\$005189	10A	NO	0.015 mg/L	0.510 mg/L	0.500 mg/L	100.50
	Total N	umber of Spikes = 4		· · · · · · · · · · · · · · · · · · ·	Delow acceptance = 0		
	Number	of Samples Used for	Statistics = 4		Above acceptance # 3		
	Hean I	Recovery # 99			Within acceptance = 4		
	Standar	d Deviation =	.86		Acceptance Criteria	75.00 - 125.00	

Statistics calculated only for samples with a valid recovery. NC: Not Calculable

Table F6 (Continued)

				Sample	Spiked Sample	Spike	x
Date	Lab ID	Lab Fraction	flag	Result	Result	Added	Recovery
Method:	ICP Metals	by \$16010					
	Solid Subm						
	nalyte: 8a						
Type of	Spike = Met	thod Spike (Into Blank)) .				
27-Aug-9	0 9008041	00		0.00 mg/L	0.959 mg/L	1,000 mg/L	95.9
		number of Spikes = 1			Selow acceptance = 0		
		of Samples Used For St	atistics = 1		Above acceptance = 0		
		Recovery = 95			Within acceptance = 1		
	Standar	d Deviation =			Acceptance Criteria	75,00 - 125,00	
	ICP Metals	.,					
	Solid Subme						
WIXEG N	nalyte: Cad	ZT. I CAN					
ype of s	Spike = Met	hod Spike (Into Blank)	•				
27-Aug-90	9063041	40		0.00 mg/L	0.929 mg/L	1.000 mg/L	92.9
		umper of Spikes = 1			Below acceptance = 0	·····	
		of Samples Used for St	atistics = 1		Above acceptance = 0		
		Recovery = 92			Within acceptance # 1		
	Standar	d Deviation =			Acceptance Criteria	75.00 - 125.00	
	CP Metals	•					
	olid Subme miyte: Chri						
		hod Spike (Into Blank).					
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	pring =gv	The spirit (III(S 3(2III))	•				
-	9008041			0.00 mg/L	0.949 mg/L	1.000 mg/L	94.9
	9008252			0.00 mg/L	1.010 mg/L	1.000 mg/L	101.0
5-0ct-90	9008262	CO		0.00 mg/L	0.995 mg/L	1.000 mg/L	99.5
ype of S	pike = metr	ix spike.					
5-Jul-90	9007040	224		0.391 mg/L	1.370 mg/L	1.000 mg/L	97.90
5-Jul-90	9007040	229		0.391 mg/L	1.370 mg/L	1.000 mg/L	97.90
6-Jul-90	9007040	19A		0.081 mg/L	1.040 mg/L	1.000 mg/L	95.90

Table F6 (Continued)

Date	Cab ID	Lab Fraction	Flag	Sample Result	Spiked Sample Result	Spike Added	% Recovery
Method: I	CP Metals	by \$46010					
Matrix: S	olid Subm	etnix: T					
Analyte:	Chromium						
Type of S	oike: mat	rix spike. continued					
26-Jul-90	9007040	198		0.081 mg/L	1.050 mg/L	1.000 mg/L	96.9
	Total I	tumber of Spikes = 7			Selow acceptance = (9	
	Number	of Samples Used For S	tatistics = 7		Above acceptance = (3	
	Hean X	Recovery # 97			Within acceptance =	7	
	Standar	rd Deviation = 2.0	7		Acceptance Criteria	75.00 - 125.00	
lethod: 10	P Metals	by \$86010					
latrix: Sc	ilid Submi	trix: T					
Spiked And	ilyte: Iro	×n					
Type of Sp	ike = Met	hod Spike (Into Blank)).				
3-0ct-90	9008262	00		0.00 mg/L	9.810 mg/L	10.0 mg/L	98.10
19-0ct-90	9008262	00		0.00 mg/L	9.930 mg/L	10.0 mg/L	99.30
ype of Sp	ike = mas	rix spike.					
5-Jul-90	9007040	198		3.920 mg/L	13.4 mg/L	10.0 mg/L	94.80
	9007040			3.920 mg/L	13.6 mg/L	10.0 mg/L	96.80
5-Jul-90	9007040	22A		0.153 mg/L	10.2 mg/L	10.0 mg/L	100.47
5-Jul-90	9007040	223		0.153 mg/L	10.1 mg/L	10.0 mg/L	99.47
	Total H	umper of Spikes = 6			Selow acceptance # 0		· · · · · · · · · · · · · · · · · · ·
	Number	of Samples Used For St	atistics = 6		Above acceptence = 0		
	Hean X	Recovery = 98			Within acceptance =	6	
	Stendan	d Deviation = 2.07			Acceptance Criteria	75.00 - 125.00	

Statistics calculated only for samples with a valid recovery.NC: Not Calculable

Table F6 (Continued)

					Spiked		
				Sample	Sample	Spike	*
Date	Lab ID	Lab Fraction	Flag	Result	Result	Added	Recovery
Method: [CP Metals	by \$46010					
Hatrix: S	olid Subme	itrix: T					
Spiked An	atyte: Les	kd					
Type of S	pike = Met	hod Spike (Into Blank	٠.				
27-409-90	9008041	CO		0.00 mg/L	0.961 mg/L	1.000 mg/L	96.
34-0ct-90	9008262	00		0.00 mg/L		1.000 mg/L	99.
)8-0ct-90	9008262	00		0.00 mg/L	•	1.000 mg/L	97.
Type of S	oike ≈ met	rix spike.					
25-Jul-90	9007040	22A	ND	0.050 mg/L	0.948 mg/L	1.000 mg/L	92.3
25-Jul-90	9007040	223	NO	0.050 mg/L		1.000 mg/L	94.3
	9007040		KO	0.100 mg/L	0.937 mg/L	1.000 mg/L	88.7
6-1ut-90	9007040	198	ND	0.100 mg/L	0.949 mg/L	1.000 mg/L	89.9
	Total No	mper of Spikes = 7			Below acceptance = 0		
	Number	of Samples Used For S	atistics = 7		Above acceptance = 0		
		Recovery = 94			Within acceptance = 7		
	Standard	1 Deviation = 3.93	3	•	Acceptance Criteria		
	P Metals b						
	lid Submat						
piked Ana	lyte: Nich	el					
ype of sp	ike = Heth	od Spike (Into Blank)					
	9008262			0.00 mg/L	1.000 mg/L	1.000 mg/L	100.0
3-0ct-90	9008262	00		0.00 mg/L	1.020 mg/L	1.000 mg/L	102.0
ype of Sp	ike = matr	ix spike.					
	9007040		ND	0.020 mg/L	0.971 ոգ/լ	1.000 mg/L	96.1
	9007040	22A	NO	0.020 mg/L	0.968 mg/L	1.900 mg/L	95.80
-Jul-90		19A		0.166 mg/L	1.100 mg/L	1.000 mg/L	93.40
-Jul-90	9007040	198		0.166 mg/L	1.130 mg/L	1.000 mg/L	96.4
	Total Nur	noer of Spikes = 6			Below acceptance = 0		
		f Samples Used For St	itistics * 6		Above acceptance = 0		
	Mass 7 2	covery = 97			Within acceptance #/6		

Statistics calculated only for samples with a valid recovery.NC: Not Calculable

Table Fó (Continued)

Date	Lab ID	Lab Fraction	Flag	Sample Result	Spiked Sample Result	Spike Added		% Recovery
Method: II	CP Metals	by sw6010						
Matrix: So	olid Subm	atrix: T						
Analyte:)	lickel							
Type of Sp	oike: meti	rix spike. continued						
	Standar	d Deviation = 3.13	3		Acceptance Criteria	75.00 -	125.00	
Method: 10	P Metals	by \$46010						
Matrix: So	olid Subme	itrix: T						
Spikæd Ana	styte: Sil	ver						
Type of Sp	oike = Met	thod Spike (Into Blank)	١.					
27-Aug-90	9008041	co		0.00 mg/L	0.910 mg/L	1.000	mg/L	91.0
		umber of Spikes * 1 of Samples Used For St	atistics = 1		Below acceptance = 0 Above acceptance = 0			
	Mean X Stanoar P Metals	Recovery = 91 d Deviation = by SW6010			Within acceptance = 1 Acceptance Criteria		125.00	
Matrix: So Spiked Ana	Hean X Stanoar P Metals Olid Subma Olyte: Chr	rd Deviation = by Su6010 crix: N/A conics			Within acceptance = 1		125.00	
Matrix: So Spiked Ana Type of Sp	Mean X Stanoar P Metals plid Subme plyte: Chr pike = Met	by Su6010 atrix: N/A comite hod Spike (Into Blank)			Within acceptance = 1 Acceptance Criteria	75.00 -		104.0
Matrix: So Spiked Ana Type of Sp 11-Jul-90	Mean X Stanoar P Metals olid Subme Nyte: Chr wike = Met S007047	by Su6010 atrix: N/A comitm had Spike (Into Blank)		0.00 mg/ k g	Within acceptance = 1 Acceptance Criteria 0.212 mg/Kg	0.200	mg/Kg	106.0 105.0
Matrix: So Spiked Ana Type of Sp 11-Jul-90 11-Jul-90	Mean X Standar P Metals Did Subme Divte: Chr Dike = Met S007047 S007046	by Su6010 atrix: N/A comite hod Spike (Into Blank) 00 00A			Within acceptance = 1 Acceptance Criteria 0.212 mg/Kg 0.210 mg/Kg	75.00 -	mg/Kg mg/Kg	105.0
Matrix: So Spiked Ana Type of Sp 11-Jul-90 11-Jul-90 26-Sep-90	Mean X Standar P Metals Did Subme Dive: Chr Dike = Met S007047 S007046 9008262	by Su6010 atrix: N/A comite hod Spike (Into Blank) 00 00A		0.00 mg/kg 0.00 mg/kg	Within acceptance = 1 Acceptance Criteria 0.212 mg/Kg 0.210 mg/Kg	0.200 0.200	mg/Kg mg/Kg	105.0
Matrix: So Spiked Ana Type of Sp 11-Jul-90 11-Jul-90 26-Sep-90	Mean X Standar P Metals blid Subme blyte: Chr bike = Met \$007047 \$007046 9008262	by Su6010 arrix: N/A comiton hod Spike (Into Blank) 00 00A 00 rix spike.		0.00 mg/kg 0.00 mg/kg	Within acceptance = 1 Acceptance Criteria 0.212 mg/Kg 0.210 mg/Kg	0.200 0.200	mg/Kg mg/Kg mg/Kg	105.0
Matrix: So Spiked Ana Type of Sp 11-Jul-90 11-Jul-90 26-Sep-90 Type of Sp	Mean X Standar P Metals blid Subme blyte: Chr pike = Met \$007047 \$007046 9008262	by Su6010 arrix: N/A comiton hod Spike (Into Blank) 00 00A 00 rix spike.		0.00 mg/kg 0.00 mg/kg 0.00 mg/kg	Within acceptance = 1 Acceptance Criteria 0.212 mg/Kg 0.210 mg/Kg 0.940 mg/Kg	0.200 0.200 0.200 1.000	mg/Kg mg/Kg mg/Kg	105.0
Matrix: So Spiked Ana Type of Sp 11-Jul-90 11-Jul-90 26-Sep-90 Type of Sp 21-May-90 21-May-90	Mean X Standar P Metals blid Subme blyte: Chr pike = Met \$007047 \$007046 \$008262 pike = met \$005159 \$005159	by Su6010 arrix: N/A comiton hod Spike (Into Blank) 00 00A 00 rix spike.		0.00 mg/kg 0.00 mg/kg 0.00 mg/kg 312.2 mg/kg	Within acceptance = 1 Acceptance Criteria 0.212 mg/Kg 0.210 mg/Kg 0.940 mg/Kg	0.200 0.200 0.200 1.000	mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	105.0
Matrix: So Spiked Ana Type of Sp 11-Jul-90 11-Jul-90 26-Sep-90 Type of Sp 21-May-90	Mean % Standard Stand	by Su6010 arrix: N/A comiton hod Spike (Into Blank) 00 00A 00 rix spike. 34A 35A 37A		0.00 mg/kg 0.00 mg/kg 0.00 mg/kg 312.2 mg/kg 312.2 mg/kg	Within acceptance = 1 Acceptance Criteria 0.212 mg/Kg 0.210 mg/Kg 0.940 mg/Kg mg/Kg	0.200 0.200 0.200 1.000	mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	105.0
Matrix: So Spiked Ana Type of Sp 11-Jul-90 11-Jul-90 26-Sep-90 Type of Sp 21-May-90 21-May-90	Mean % Standard Stand	by Su6010 arrix: N/A comiton hod Spike (Into Blank) 00 00A 00 rix spike. 34A 35A 37A 39A		0.00 mg/kg 0.00 mg/kg 0.00 mg/kg 312.2 mg/kg 312.2 mg/kg 85.5 mg/kg	Within acceptance = 1 Acceptance Criteria 0.212 mg/Kg 0.210 mg/Kg 0.940 mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	0.200 0.200 1.000 27.9 27.4 25.9	mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	105.0
Matrix: So Spiked Ana Type of Sp 11-Jul-90 11-Jul-90 26-Sep-90 Type of Sp 21-May-90 21-May-90 21-May-90 21-May-90	Mean % Standard Stand	by Su6010 Arrix: H/A Arrix: H/A Arrix: H/A Britis: H/		0.00 mg/kg 0.00 mg/kg 0.00 mg/kg 312.2 mg/kg 312.2 mg/kg 85.5 mg/kg 163.6 mg/kg	Within acceptance = 1 Acceptance Criteria 0.212 mg/Kg 0.210 mg/Kg 0.940 mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	0.200 0.200 0.200 1.000 27.9 27.4 25.9 24.3	mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	105.0
Matrix: So Spiked Ana Type of Sp 11-Jul-90 11-Jul-90 26-Sep-90 Type of Sp 21-May-90 21-May-90 21-May-90 21-May-90 21-May-90	Mean % Standard Stand	by Su6010 rerix: H/A comicm chod Spike (Into Blank) 00 00A 00 rix spike. 34A 35A 37A 39A 38A 36A		0.00 mg/Kg 0.00 mg/Kg 0.00 mg/Kg 312.2 mg/Kg 312.2 mg/Kg 35.5 mg/Kg 163.6 mg/Kg 163.6 mg/Kg	Within acceptance = 1 Acceptance Criteria 0.212 mg/Kg 0.210 mg/Kg 0.940 mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	0.200 0.200 0.200 1.000 27.9 27.4 25.9 24.3 24.8	mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	104.0 105.0 94.0
Matrix: So Spiked Ana Type of Sp 11-Jul-90 11-Jul-90 26-Sep-90 Type of Sp 21-May-90 21-May-90 21-May-90 21-May-90 21-May-90 21-May-90	Mean X Standar P Metals blid Subma blyte: Chr pike = Met \$007047 \$007046 \$008262 pike = mat \$005159 \$005159 \$005159 \$005159 \$005159 \$005159 \$005159	by Su6010 renix: H/A romicm hod Spike (Into Blank) 00 00A 00 rix spike. 34A 35A 37A 39A 38A 36A 10A	•	0.00 mg/kg 0.00 mg/kg 0.00 mg/kg 312.2 mg/kg 312.2 mg/kg 35.5 mg/kg 163.6 mg/kg 163.6 mg/kg 85.5 mg/kg	Within acceptance = 1 Acceptance Criteria 0.212 mg/Kg 0.210 mg/Kg 0.940 mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	0.200 0.200 1.000 27.9 27.4 25.9 24.3 24.8 28.6	mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	105.0 94.0

Table F6 (Continued)

					Spiked			
				Sample	Sample	Spike		x
Dete	Lab 10	Lab Fraction	Flag	Result	Result	Added		Recovery
lethod: [0	P Metals	by \$46010						
Matrix: So	olid Subma	itrix: H/A						
Analyte: 0	hromium							
Type of Sp	ike: metr	ix spike, continued						
02-Jun-90	S005184	250		11.6 mg/Kg	28.1 mg/Kg	18.0	mg/Kg	21.6
5-Jun-90	\$00\$186	05A		44.6 mg/Kg	108.0 mg/Kg	26.4	mg/Kg	240.1
15-Jun-90	\$005186	030		44.6 mg/Kg	57.9 mg/Kg	25.0	mg/Kg	53.2
7-Jun-90	5005190	10A		586.2 mg/Kg	mg/Kg	721.0	mg/Kg	
7-Jun-90	\$005190	09A		586.2 mg/Kg	mg/Kg	25.5	mg/Kg	
8-Jun-90	5005190	28A		48.6 mg/Kg	82.6 mg/Kg	31.4	mg/Kg	105.2
8-Jun-90	\$005190	27A		48.6 mg/Kg	105.7 mg/Kg	29.5	mg/Kg	193.5
9-Jun-90	5005247	25A		1595.5 mg/Kg	mg/Kg	24.0	mg/Kg	
9-Jun-90	\$005247	28A		4530.5 mg/Kg	mg/Kg	27.9	mg/Kg	
9-Jun-90	5005247	27A		4530.5 mg/Kg	mg/Kg	26.0	Rg/Kg	
9-Jun-90	5005247	26A		1595.5 mg/Kg	mg/Kg	22.4	mg/Kg	
9-Jun-90	\$005247	29A		4650.8 mg/Kg	mg/Kg	26.5	mg/Kg	
9-Jun-90	5005247	30A		4650.8 mg/Kg	mg/Kg	27.6	mg/Kg	
1-Jul-90	5007046	12A		4166.0 mg/Kg	6616.9 mg/Kg	2271.6	mg/Kg	107.8
1-Jul-90	5007046	13A		4166.0 mg/Kg	4384.5 mg/Kg	2198.7	mg/Kg	9.9
1-Jul-90	\$007046	15A		3350.0 mg/Kg	4691.5 mg/Kg	2173.8	mg/Kg	61.7
1-Jul-90	5007046	16A		3350.0 mg/Kg	7270.1 mg/Kg	2070.9	mg/Kg	189.2
1-Jul-90	5007046	10),		1286.0 mg/Kg	1759.0 mg/Kg	572.4	mg/Kg	82.6
1-301-90	\$007046	09A		1286.0 mg/Kg	2137.6 mg/Kg	544.6	mg/Kgʻ	156.3
2-Jul-90	5007047	13A		88.0 mg/Kg	149.7 mg/Kg	72.3	mg/Kg	85.3
Z-Jul-90	5007047	010		551.0 mg/Kg	821.6 mg/Kg	227.7	mg/Kg	118.8
2-Jul-90	\$007047	01A		551.0 mg/Kg	752.0 mg/Kg	233.5	mg/Kg	86.0
2-Jul-90	\$007047	130		88.0 mg/Kg	143.8 mg/Kg	69.8	mg/Kg	79.9
2-Jul-90	5007047	070		28.0 mg/Kg	71.8 mg/Kg	38.9	mg/Kg	112.6
2-Jul-90	\$007047	07A		28.0 mg/Kg	64.1 mg/Kg	35.5	mg/Kg	101.6
7-Jul-90	\$007047	040		48.0 mg/Kg	154.9 mg/Kg	91.3	~g/Kg	117.0
7-Jul-90	\$007047	04A		48.0 mg/Kg	145.7 mg/Kg	93.5	mg/Kg	104.4
7-Jul-90	5007047	16A		231.0 mg/Kg	457.5 mg/Kg	122.5	mg/Kg	184.9
7-Jul-90	5007047	160		231.0 mg/Kg	355.4 mg/kg	117.3	mg/Kg	106.0
4-Jul-90	9007040	038		1223.0 mg/Kg	4440.0 mg/Kg	3750.0	mg/Kg	85.7
4-Jul-90	9007040	03A		1223.0 mg/Kg	4030.0 mg/kg	3000.0	mg/Kg	93.5
6-141-90	S007047	10A		7699.0 mg/Kg	11334.4 mg/Kg	6764.5	mg/Kg	53.7
6-Jul-90	5007047	100		7699.0 mg/Kg	11234.5 mg/kg	6776.0	mg/Kg	52.18

Total Number of Spikes # 45

Below acceptance = 19

Number of Samples Used For Statistics = 31

Above acceptance = 5

Statistics calculated only for samples with a valid recovery, MC: Not Calculable

Table F6 (Continued)

******	******	**********		: ro (Continue		*********	********	*****
				Samole	Spiked Sample	Spike		ı
Date	tab ID	Lab Fraction	Flag	Result	Result	Added		overy
ethod: 10	P Metals	by \$16010						
		trix: W/A						
Analyte: C	hromium							
Type of Sp	ik e: ma tr	rix spike, continued						
	Mean %	Recovery = 105			Within acceptance			
	Standar	ed Deviation * 46.38			Acceptance Criteria	75.00 -	125.00	
lethod: 10		·						
latrix: So								
Spiked Ana	lyte: Iro	on .						
lype of Sp	ike = Met	hod Spike (Into Blank).						
11-Jul-90	5007046	00A		0.00 mg/K	g 1.021 mg/Kg	1.000	mg/Kg	102.
1-Jul-90	5007047	00		0.00 mg/K	g 1.040 mg/Kg	1.000	ng/Kg	104.
6-Sep-90	9008262	00		0.00 mg/K	9,560 mg/Kg	10.0	ng/Kg	95.
'ype of Sp	ike = met	rîx spike.						
21-Hay-90	5005159	36A		2440ú.2 mg/K	a mg/Ka	142.8	ng/Kg	
1-May-90	5005159	35A		10.5 mg/K	mg/Kg	137.1	ng/Kg	
1-Hay-90	\$005159	39A		5783.6 mg/K	g ng/Kg	121.4	ng/Kg	
11-May-90				2440j.2 mg/Ki		129.6		
1-Hay-90		38A		5783.6 mg/X		124.1		
1-May-90				10.5 mg/K		139.3 m		0.4
9-Hay-90		11A 10A		mg/K		93.9 #		
9-May-90 2-Jun-90				mg/Ki	•	97.9 m 96.8 m		
2-Jun-90				ng/K ng/K		93.9		
5-Jun-90				23873.4 mg/Xi		97.8		
5-Jun-90				23873.4 mg/K			ng/Kg	
7-Jun-90				6096.6 mg/K		127.5 m		
7-Jun-90		10A		6096.6 mg/Kg		7134.3 n	-	
8-Jun-90	5005190	284		24685.0 mg/K		156.9 m		
8-Jun-90	\$005190	27A		24685.0 mg/Kg		147.4 8		
9-Jun-90	5005247	27A		30101.8 mg/Kg		130.0 л		
9-Jun-90	5005247	28A		30101.8 mg/Kg		139.6 m		
9-Jun-90	5005247	29A		31938.3 mg/Kg		132.4 m		
9-Jun-90	5005247	25A		34577.3 mg/Kg		120.1 #	-	
	5005247	7Aa		34577.3 mg/Kg	,. ·	111.7 N		

Statistics calculated only for samples with a valid recovery,NC: Not Calculable

Table F6 (Continued)

					Spiked			
Date	Lab ID	Lab Fraction	Flag	Sample Result	Sample Result	Spike Added		% Recovery
								
		by \$46010						
		strix: H/A						
Analyte:								
Type of S	pike: meti	ix spike, continued						
19-Jun-90	\$005247	30A		31938.3 mg/Kg	mg/Kg	137.9	ma/Ka	
11-Jul-90	s007046	12A		20927.0 mg/Kg	mg/Kg		mg/Kg	
11-Jul-90	5007046	1SA		21425.0 mg/Kg	mg/Kg		mg/Kg	
11-Jul-90	\$007046	09A		1351.0 mg/kg	mg/Kg		mg/Kg	
12-Jul-90	\$007047	01A		7179.0 mg/kg	9443.4 mg/Kg	2335.3		96.9
12-Jul-90	\$007047	010		7179.0 mg/kg	8725.1 mg/Kg	2276.6		67.9
17-Jul-90	\$007047	16A		6897.0 mg/Kg	10201.7 mg/Kg	3674.2		89.9
17-Jul-90	S007047	160		6897.0 mg/Kg	10135.0 mg/Kg	3519.0		92.0
26-Jul-90	\$007047	100		28471.0 mg/Kg	40022.2 mg/Kg	13552.0		85.2
26-Jul-90	5007047	10A		28471.0 mg/Kg	37857.2 mg/Kg	13529.0		69.3
		d Deviation = 30.6	•		Acceptance Criteria	75.00 -	125.00	
	P Metals							
	olid Su bma slyte: Lea							
DIVEG NI	ityte. Les	-						
'ype of Sp	ike = Met	h∝d Spike (Into Blank) .					
1-Jul-90	5007046	00A		0.00 mg/Kg	0.518 mg/Kg	0.500	mq/Kq	103.6
1-101-90	\$007047	00		0.00 mg/Kg	0.531 mg/Kg	0.500	-	106.2
	9008262	00		0.00	0.908 mg/Kg		mg/Kg	90.8
6-Sep-90	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			0.00 mg/xg	0.70d mg/kg	1.000		
6-Sep-90		rix spike.		U.UU mg/Ig	0.90d ng/kg	1.000		
6-Sep-90 ype of Sp		,					-	101 1
6-Sep-90 ype of Sp 1-May-90	ike = met	384		6.900 mg/Kg	69.6 mg/kg	62.0	mg/Kg	101.1
6-Sep-90 ype of Sp 1-May-90 1-May-90	ike = met	384 344		6.900 mg/kg 0.00 mg/kg	69.6 mg/Kg 1.700 mg/Kg	62.0 69.7	mg/Kg mg/Kg	2.4
6-Sep-90 ype of Sp 1-May-90 1-May-90 1-May-90	s005159 5005159	38A 34A 39A		6.900 mg/Kg 0.00 mg/Kg 6.900 mg/Kg	69.6 mg/Kg 1.700 mg/Kg 69.0 mg/Kg	62.0 69.7 60.7	mg/Kg mg/Kg mg/Kg	2.4 102.3
6-Sep-90 ype of Sp 1-May-90 1-May-90 1-May-90 1-May-96	s005159 s005159 s005159	38A 34A 39A 35A		6.900 mg/kg 0.00 mg/kg 6.900 mg/kg 0.00 mg/kg	69.6 mg/Kg 1.700 mg/Kg 69.0 mg/Kg 102.5 mg/Kg	62.0 69.7 60.7 68.5	mg/Kg mg/Kg mg/Kg mg/Kg	2.4 102.3
6-Sep-90 ype of Sp 1-May-90 1-May-90 1-May-90 1-May-90 1-May-90	5005159 5005159 5005159 5005159	38A 34A 39A 35A 36A		6.900 mg/kg 0.00 mg/kg 6.900 mg/kg 0.00 mg/kg 56.4 mg/kg	69.6 mg/Kg 1.700 mg/Kg 69.0 mg/Kg 102.5 mg/Kg mg/Kg	62.0 69.7 60.7 68.5 71.4	mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	
6-Sep-90 ype of Sp 1-May-90 1-May-90 1-May-96 1-May-90 1-May-90 1-May-90	S005159 S005159 S005159 S005159 S005159	384 344 394 354 364 374		6.900 mg/kg 0.00 mg/kg 6.900 mg/kg 0.00 mg/kg	69.6 mg/Kg 1.700 mg/Kg 69.0 mg/Kg 102.5 mg/Kg	62.0 69.7 60.7 68.5	mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	2.4 102.3

Statistics calculated only for samples with a valid recovery, NC: Not Calculable

Table F6 (Continued)

					Spiked			
				Sample	Sample	Spike		x
Date	Lab IO	Lab Fraction	Flag	Result	Result	Added		Recovery
			rtag	X 65 U. C	xesutt	AQJeu		Recovery
Method: 1	CP Metals	by \$46010						
Matrix: S	olid Subm	ntrix: N/A						
Analyte:	Lead							
Type of \$	pike: mati	rix spike, continued						
02-Jun-90		25A		14.9 mg/Kg	61.9 mg/Kg	48.4	ng/Kg	97.11
02-Jun-90		250		14.9 mg/Kg	55.8 mg/Kg	44.9	mg/Kg	91.09
15-Jun-90		050		31.4 mg/Kg	104.5 mg/Kg	62.6	mg/Kg	116.77
15-Jun-90	S005186	05A		31.4 mg/Kg	106.4 mg/Kg	66.1	mg/Kg	113.46
17-Jun-90		09A		7.100 mg/Kg	69.8 mg/Kg	63.8	mg/Kg	98.28
17-Jun-90	5005190	10A		7.100 mg/Kg	69.7 mg/Kg	60.9	ng/Kg	102.79
18-Jun-90	\$005190	28A		30.6 mg/Kg	109.3 mg/Kg	78.5	mg/Kg	100.25
18-Jun-90	5005190	27A		30.6 mg/Kg	107.2 mg/Kg	73.7		103.93
19-Jun-90	\$005247	30A		332.6 mg/Kg	mg/Kg	69.0	mg/Kg	
19-Jun-90	s005247	29A		332.6 mg/Kg	mg/Kg	66.2		
19-Jun-90	5005247	26A		347.1 mg/Kg	mg/Kg	55.9	mg/Kg	
19-Jun-90	\$005247	28A		79.1 mg/Kg	297.3 mg/Kg	69.8	mg/Kg	312.61
19-Jun-90	\$005247	27A		79.1 mg/Kg	359.8 mg/Kg	65.0	mg/Kg	431.85
19-Jun-90	\$005247	25A		347.1 mg/Kg	414.5 mg/Kg	60.1	mg/Kg	112.15
11 · Jul - 90	\$007046	16A		444.0 mg/Kg	1517.8 mg/Kg	1380.6	mg/Kg	77.78
11-Jul-90	s007046	15A		444.0 mg/Kg	1548.5 mg/Kg	1449.2	mg/Kg	74.10
11-Jul-90	5007046	09A		242.0 mg/Kg	1520.0 mg/Kg	1089.1	mg/Kg	117.34
11-Jul-90	\$007046	10A		242.0 mg/Kg	1395.1 mg/Kg	1144.8	mg/Kg	100.73
11-Jul-90	5007046	124		356.0 mg/Kg	1676.1 mg/Kg	1514.4	mg/Kg	87.17
1-Jul-90	5007046	13A .		356.0 mg/Kg	1538.5 mg/Kg	1465.8	mg/Kg	80.67
2-Ju! -90	s007047	190		28.0 mg/Kg	90.1 mg/Kg	49.0	mg/Kg	125.73
2-Jul-90	5007047	130		58.0 mg/Kg	146.9 mg/Kg	97.8	mg/Kg	90.90
2-Jul-90	3007047	13A		58.0 mg/Kg	155.1 mg/Kg	101.2	mg/Kg	95.95
5-1nf-80	\$007047	19A		28.0 mg/Kg	81.5 mg/Kg	52.0	mg/Kg	102.88
4-Jul-90	9007040	038		451.0 mg/Kg	528.0 mg/Kg	312.5	mg/Kg	21.44
4-101-90	9007040	AE0		461.0 mg/Kg	507.0 mg/Kg	250.0	mg/Kg	18.40
6-Jul-90	s007047	10A		45.0 mg/Kg	703.5 mg/Kg	1352.9	mg/Kg	48.60
09-Jul-69	\$007047	סיו		46.0 mg/Kg	715.0 mg/Kg	1355.2		49.37

Total Number of Spikes = 39

Number of Samoles Used For Statistics = 34

Mean % Recovery # 106

Standard Deviation = 75.61

Below acceptance = 12

Above acceptance = 4

Within acceptance = 18
Acceptance Criteria = 75.00 - 125.00

Table Fó (Continued)

					Spiked				
				Sample	Sample	Spike		X	
Date	Lab ID	Lab Fraction	Flag	Result	Result	Added		Recovery	
Method: IC	P Netals	by 546010							
Metrix: So	alid Submy	itrix: H/A							
Spiked Ana	ilyte: Nic	ikel							
Type of Sp	oike = Het	thod Spike (Into Blani	ο.						
11-Jul-90	\$007047	00		0.00 mg/kg	0.515 mg/Kg	0.500 *	ng/Kg	103.00	
26-Sep-90	9008262	00		0.00 mg/Kg	0.927 mg/Kg	1.000 π	ng/Kg	92.70	
Type of Sp	oike = met	rix spike.							
21-Hay-90	5005159	39A		6.900 mg/Kg	71.1 mg/Kg	60.7 m	ng/Kg	105.77	
21-May-90	5005159	38A		6.900 mg/Kg	72.2 mg/Kg	62.0 m	ng/Kg	105.32	
21-May-90	5005159	35A		51.3 mg/Kp	118.4 mg/Kg	68.5 ¤	ng/Kg	97.96	
21-Hay-90	5005159	34A		51.3 mg/Kg	110.4 mg/Kg	69.7 m	ng/Kg	84.79	
21-May-90	5005159	36A		24.2 mg/Kg	mg/Kg	71.4 m	ng/Kg		
21-Hay-90	5005159	37A		24.2 mg/Kg	mg/Kg	64.3 m	ng/Kg		
29-Hay-90	\$005184	11A		15.5 mg/Kg	62.5 mg/Kg	46.9 m	ㅋ/Kg	100.21	
29-Hay-90	SC05184	10A		15.5 mg/Kg	65.1 mg/Kg	49.0 m	1g/Kg	101.22	
02-Jun-90	\$005184	25A		10.6 mg/Kg	60.9 mg/Kg	48.4 m	ng/Kg	103.93	
02-Jun-90	\$005184	250		10.6 mg/Kg	57.7 mg/Kg	44.9	ıg/Kg	104.90	
15-Jun-90	\$005186	05A		18.0 mg/Kg	84.0 mg/Kg	66.1 m	ıg/Kg	98.64	
15-Jun-90	\$005186	050		18.8 mg/Kg	79.4 mg/Kg	62.6 #	1 g/ <g< td=""><td>96.81</td></g<>	96.81	
17-Jun-90	\$005190	09A		6.600 mg/Kg	68.9 mg/Kg	63.8 #	×g/Kg	97.65	
17-Jun-90	\$005190	10A		6.600 mg/Kg	71.0 mg/kg	60.9 m	1 g/Kg	105.75	
18-Jun-90		27A		20.3 mg/Kg	96.2 mg/Kg	73.7 s	g/Kg	102.99	
18-Jun-90	\$005190	28A		20.3 mg/Kg	99.8 mg/Kg	78.5 #	xg/Kg	101.27	
19-Jun-90	\$005247			40.8 mg/Kg	132.4 mg/Kg	69.0 m	¥g/Xg	132.75	
19-Jun-90	\$005247	27A		32.1 mg/Kg	97.7 mg/Kg		g/Kg	100.97	
19-Jun-90	5005247	28A		32.1 mg/Kg	108.6 mg/Kg	69.8 m	1 9/Kg	109.60	
19-Jun-90	\$005247	25A		37.7 mg/Kg	102.8 mg/Kg	60.1 m	9/Kg	108.32	
19-Jun-90	\$005247			40.8 mg/Kg	100.6 mg/Kg		zg/Kg	90.33	
19-Jun-90	5005247	26A		37.7 mg/Kg	78.8 mg/Kg	55.9 m	19/K g	73.52	
12-Jul-90		13A		23.0 mg/kg	113.2 mg/Kg	101.2 m	ıg/Kg	89.13	
12-Jul-90	5007047	130		23.0 mg/Kg	109.1 mg/Kg	97.8 m	ıg/Kg	88.02	
4-Jul-90	9007040	038		32.5 mg/Kg	65.6 mg/Kg	43.8 m	xg/Kg	75.57	
24-Jul-90	9007040	03A		32.5 mg/Kg	66.7 mg/Kg	35.0 m	g/Kg	97.71	

Total Number of Spikes * 28
Number of Samples Used For Statistics * 26
Mean % Recovery * 98

Below acceptance = 3 Above acceptance = 1 Within acceptance = 22

Statistics calculated only for samples with a valid recovery, NC: Not Calculable

Table F6 (Continued)

				Sample	Spiked Sample	Spike	x
Date	Lab ID	Lab Fraction	Flag	Result	Result	Added	Recovery
Hethod: I	CP Metals	by \$46010					
Matrix: S	alid Subme	itrix: N/A					
Analyte:	Nickel						
Type of S	pike: metr	ix spike, continued					
	Stander	d Deviation = 11.5	1		Acceptance Criteria	75.00 - 125.00	
	CP Metals	· ·					
Matrix: T	REATED SUE	matrix: MV					
Spiked An	elyte: Chr	onium					
Type of S	pike = Met	hod Spike (Into Blank).				
19-Sep-90	9008204	0		0.00 mg/L	0.963 mg/L	1.000 mg/L	96.30
19-Sep-90	9008327	•		0.00 mg/L	1.010 mg/L	1.000 mg/L	101.00
26-Sep-90	9009182	00		0.00 mg/L	0.942 mg/L	1.000 mg/L	94.20
Type of S	pike = met	rix spike.					
19-\$ep-90	9009045	19 C		0.042 mg/L	0.235 mg/L	0.200 mg/L	96.50
19-Sep-90	9009045	198		0.042 mg/L	0.224 mg/L	0.200 mg/L	91.00
	9008399		<5x	0.086 mg/L	0.271 mg/L	0.200 mg/L	92.50
19-s ep -90	9008399	218	<5x	0.086 mg/L	0.269 mg/L	0.200 mg/L	. 91.50
	Total N	umber of Spikes = 7			Below acceptance = 0		
		of Samples Used For S	tatistics = 7		Above acceptance = 0		
		Recovery = 94	_		Within acceptance = 7		
	Standar	d Deviation # 3.5	2		Acceptance Criteria	75.00 - 125.00	
	P Metals	•			,		
		matrix: MV					
Spiked Ana	lyte: Iro	•					
type of sp	ike = Heti	nod Spike (Into Blank).				
19-Sep-90	9008327	•		0.00 mg/L	9.810 mg/L	10.0 mg/L	98.10
20-Sep-90	9008204	0		0.00 mg/L	9.610 mg/L	10.0 mg/L	96.10
	Total N	mper of Spikes = 2			Below acceptance = 0		
	Number (of Samples Used for S	tatistics = 2		Above acceptance = 0		
	Maan Y	Recovery # 97			Within acceptance =.2		

(Continued)

Statistics calculated only for samples with a valid recovery.NC: Not Calculable

Table Fá (Continued)

Date	Lab ID	Lab Fraction	Flag	Sample Result	Spiked Sample Result	Spike Added	% Recovery
Method: IC	P Hetals	by \$96010					
latrix: TR	EATED Sub	metrix: MV					
inalyte: I	ron						
lype of Sp	ike: Meth	od Spike (Into Bla	nk), continued				
	Standar	d Devistion =	1.41		Acceptance Criteria	75.00 - 125.00	
lethod: IC	Metals .	by \$46010					
		metrix: MV					
Spiked Ana	lyte: Lea	đ					
ly p e of Sp	ike = Meti	hod Spike (Into Bl	ank).				
19-Sep-90	9008327	•		0.00 mg/L	0.991 mg/L	1.000 mg/L	99.10
19-Sep-90	9008204	0		0.00 mg/L	0.935 mg/L	1.000 mg/L	93.50
	Total N	umper of Spikes =	2		Below acceptance = 0		
		of Samples Used fo	r Statistics = 2	!	Above acceptance = 0		
		Recovery = 96			Within acceptance = 2		
	Standen	d Deviation =	3.95		Acceptance Criteria	75.00 - 125.00	
lethod: IC	Metals !	by sw6010					
		metrix: MW					
Spiked Ane	lyte: Nic	ket					
lype of Sp	ke = Met	hod Spike (Into 81	ank).				
19-Sep-90	9008327	•		0.00 mg/L	1.000 mg/L	1.000 mg/L	100.00
19-5ep-90	9008204	0		0.00 mg/L	0.951 mg/L	1.000 mg/L	95.10
	Total N	umber of Spikes =	2		Below acceptance = 0	·	
	Number	of Samples Used Fo	r Statistics = 2	!	Above acceptance # 0		
	Hean X	Recovery = 97			Within acceptance = 2		
	Standar	d Deviation =	3.46		Acceptance Criteria	75.00 - 125.00	

Statistics calculated only for samples with a valid recovery,NC: Not Calculable

Table F6 (Continued)

					Spiked		
				Sample	Sample	Spike	x
Date	Lab ID	Lab Fraction	flag	Result	Result	Added	Recovery
ethod: I	CP Metals	by \$46010					
latrix: T	REATED SU	bmetrix: T					
Spiked An	alyte: Sar	rium					
type of s	pike = Met	thod Spike (Into Blank	ο.				
14 - Seo-90	9008204	0		0.00 mg/L	0.983 mg/L	1.000 mg/L	98.
	Total N	lumber of Spikes = 1			Below acceptance = 0		
		of Samples Used For S	Statistics * 1		Above acceptance = 0		
		Recovery * 98			Within acceptance = 1		
	Stander	rd Deviation =			Acceptance Criteria	75.00 - 125.00	
ethod: I	CP Metals	by \$46010					
	PEATER SIM	metrix: T					
Spiked And	slyte: Cad	mnum :hod Spike (Into Blank).				
piked And	slyte: Cad	hod Spike (Into Blank).	0.00 mg/L	0.987 mg/L	1.000 mg/L	98.
piked And	slyte: Cad pike = Met 9008204	hod Spike (Into Blank).	0.00 mg/L	0.987 mg/L Below acceptance = 0	1.000 mg/L	98.
piked And	pike = Met 9008204 Total N	thod Spike (Into Blank O Cumpor of Spikes = 1 of Samples Used For S		0.00 mg/L		1.000 mg/L	98.
piked And	pike # Met 9008204 Total N Number Heen X	thod Spike (Into Blank Under of Spikes = 1 of Samples Used For S Recovery = 98		0.00 mg/L	Below acceptance = 0	1.000 mg/L	98.
piked And	pike # Met 9008204 Total N Number Heen X	thod Spike (Into Blank O Cumpor of Spikes = 1 of Samples Used For S		0.00 mg/L	Below acceptance = 0 Above acceptance = 0		98.
piked Anuppe of Si 4-Sep-90	9005204 Total N Number Hean X Stander	thod Spike (Into Blank Unmoer of Spikes = 1 of Samples Used For S Recovery = 98 d Deviation = by SW6010		0.00 mg/L	Below acceptance = 0 Above acceptance = 0 Within acceptance = 1		98.
piked And piked	9005204 Total N Number Mean X Stander	thod Spike (Into Blank Unmber of Spikes = 1 of Samples Used For S Recovery = 98 d Deviation = by SW6010 metrix: T		0.00 mg/L	Below acceptance = 0 Above acceptance = 0 Within acceptance = 1		98.
ethod: To	9005204 Total N Number Hean X Stander	thod Spike (Into Blank Unmoer of Spikes = 1 of Samples Used For S Recovery = 98 d Deviation = by SW6010 metrix: T		0.00 mg/L	Below acceptance = 0 Above acceptance = 0 Within acceptance = 1		98.
piked Analype of Si 4-Sep-90 ethod: IC ethix: TR piked Anal	9008204 Total N Number Mean X Stander P Metals HEATED Subs	thod Spike (Into Blank Unmoer of Spikes = 1 of Samples Used For S Recovery = 98 d Deviation = by SW6010 metrix: T	tatistics = 1	0.00 mg/L	Below acceptance = 0 Above acceptance = 0 Within acceptance = 1		98.
piked Analype of Si 4-Sep-90 ethod: IC strix: Tr piked Analype of Sp i-Sep-90	P Metals item (April 19 April	thod Spike (Into Blank Unmber of Spikes = 1 of Samples Used For S Recovery = 98 d Deviation = by SW6010 matrix: T omium hod Spike (Into Blank	tatistics = 1	0.00 mg/L	Below acceptance = 0 Above acceptance = 0 Within acceptance = 1		
piked Analype of Si 4-Sep-90 ethod: IC atrix: Tr piked Analype of Sp i-Sep-90 3-Oct-90	P Metals EATED Substitute P008204	thod Spike (Into Blank Unmber of Spikes = 1 of Samples Used For S Recovery = 98 d Deviation = by SW6010 matrix: T omium hod Spike (Into Blank 0 00	tatistics = 1	0.00 mg/L 0.00 mg/L	Below acceptance = 0 Above acceptance = 0 Within acceptance = 1 Acceptance Criteria 0.983 mg/L 1.030 mg/L	75.00 - 125.00 1.000 mg/L 1.000 mg/L	98.: 103.:
piked Analype of Si 4-Sep-90 ethod: IC strix: Tr piked Analype of Sp i-Sep-90 i-Sep-90	P Metals item (April 19 April	thod Spike (Into Blank Unmber of Spikes = 1 of Samples Used For S Recovery = 98 d Deviation = by SW6010 matrix: T omium hod Spike (Into Blank 0 00	tatistics = 1	0.00 mg/L	Below acceptance = 0 Above acceptance = 0 Within acceptance = 1 Acceptance Criteria 0.983 mg/L	75.00 - 125.00 1.000 mg/L	98. 103.
piked Analype of Si 4-Sep-90 ethod: IC matrix: TR piked Analype of Sp i-Sep-90 3-Oct-90 3-Oct-90	PO08204 Total N Mumber Mean X Stander P Metals EEATED Subs Sixe = Metil 9008204 9009182 9008327	thod Spike (Into Blank Unmber of Spikes = 1 of Samples Used For S Recovery = 98 d Deviation = by SW6010 matrix: T omium hod Spike (Into Blank 0 00	tatistics = 1	0.00 mg/L 0.00 mg/L	Below acceptance = 0 Above acceptance = 0 Within acceptance = 1 Acceptance Criteria 0.983 mg/L 1.030 mg/L	75.00 - 125.00 1.000 mg/L 1.000 mg/L	98. ¹
ethod: IC atrix: TR piked Ana piked Ana sype of Sp 3-Oct-90 spe of Sp	PO08204 Total N Mumber Mean X Stander P Metals EEATED Subs Sixe = Metil 9008204 9009182 9008327	chod Spike (Into Blank Unmmor of Spikes = 1 of Samples Used For S Recovery = 98 d Deviation = by Sw6010 matrix: T omium hod Spike (Into Blank 0 00 . rix spike.	tatistics = 1	0.00 mg/L 0.00 mg/L	Below acceptance = 0 Above acceptance = 0 Within acceptance = 1 Acceptance Criteria 0.983 mg/L 1.030 mg/L	75.00 - 125.00 1.000 mg/L 1.000 mg/L	98

Statistics calculated only for samples with a valid recovery, XC: Not Calculable

Table F6 (Continued)

					Spiked			_	
				Sample	Sample	Spike		*	
Date	Lab ID	Lab Fraction	Flag	Result	Result	Added		Recurery	
Method: I	CP Metals	by 51/6010							
		ometrix: T							
Analyte:	Chronium								
Type of S	pike: metr	rix spike. continued							
	Total k	tumber of Spikes = 5			Below acceptance =	1			
		of Samples Used For	Statistics = !	5	Above acceptance =				
		Recovery * 95			Within acceptance =				
	Standar	d Deviation = 12.	23		Acceptance Criteria	75.00 -	125.00		
		by \$46010				-			
		metrix: T							
Spiked An	slyte: [ro	×n							
Type of S	pike = Xet	thod Spike (Into Stan	k),						
04-Sep-90	9008204	o		0.00 mg/L	.170 mg/L	10.0	mg/L	91.	
03-Oct-90	9009182	00		0.00 mg/L	10.1 mg/L	10.0	mg/L	101.	
03-0ct-90	9008327	•		0.00 mg/L	9.610 mg/L	10.0	mg/L	96.	
Type of S	pike = met	rix spike.							
03-0ct-90	9009103	199		114.0 mg/L	1924.0 mg/L	10.0	mg/L	100.	
03-0ct-90	9009103	19A		114.0 mg/L	122.0 mg/L	10.0	mg/L	80.0	
	Total N	lumber of Spikes = 5			Below acceptance = 0	0			
	Number	of Samples Used For	Statistics = 5	5	Above acceptance = i	3			
	Heen X	Recovery = 93			Within acceptance =	5			
	Standar	d Devistion = 8.	52		Acceptance Criteria	75.00 -	125.00		
Method: I	IP Metals	by 596010							
Matrix: TI	REATED Sub	metrix: 1							
Spiked Ans	ilyte: Les	d							
Type of S	oike » Xet	hod Spike (Into Blani	ĸ).						
14-sep-90	9008204	0		0.00 mg/L	1.010 mg/L	1.000	mg/L	101.	
	9008327	•		0.00 mg/L	0.935 mg/L	1.000	mg/L	93.	
13·0ct·90		00		0.00 mg/L	1.050 mg/L	1,000		105.	

Statistics calculated only for samples with a valid recovery.NC: Not Calculable

Table F6 (Continued)

					Spiked			
				Sample	Sample	Spike	x	
Date	Lab ID	Lab fraction	Flag	Result	Resuit	Added	Recovery	
Method: II	CP Metals	by \$46010						
Matrix: To	REATED SU	matrix: T						
Analyte: i	.ead							
Type of Sp	oike: met	fix spike, continued						
Type of Sp	oika = mat	rix spike.						
03-0ct-90	9009103	198		0.250 mg/L	1.150 mg/L	1,030 mg/L	90.0	
03-0ct-90	9009103	19A		0.250 mg/L	1.130 mg/L	1.000 mg/L	88.9	
		umber of Spikes = 5			Below acceptance = 0			
		of Samples Used For St.	stistics = 5		Above acceptance = 0			
		Recovery # 95			Within acceptance = 5			
	Standar	d Deviation = 7.26			Acceptance Criteria	75.00 - 125.00		
lethod: IC		•						
Matriz: TR Spiked Ana								
	•							
ype of Sp	ike = Met	hud Spike (Into Blank).	•					
4-5ep-90	9008204	0		0.00 mg/L	1,000 mg/L	1.000 mg/L	100.0	
3-0ct-90				0.00 mg/L	0.951 mg/L	1,000 mg/L	95.1	
3-0ct-90	9009182	co		0.00 mg/L	1.020 mg/L	1,000 mg/L	102.0	
ype of Spi	ike = mot	rix spike.						
3-0ct-90	9009103	19A		0.491 mg/L	1.340 mg/L	1,000 mg/L	84.9	
3-0ct-90	9009103	198		0.491 mg/L	1.350 mg/L	1,000 mg/L	85.9	
		moer of Spikes = 5			Below acceptance = 0			
		of Samples Used For Sta	tistics * 5		Above acceptance = 0			
		lecovery = 93			Within acceptance = 5			
	Standard	Deviation = 7.88			Acceptance Criteria	75.00 - 125.00		

Statistics calculated only for samples with a valid recovery, MC: Not Calculable

Table F6 (Continued)

					Spiked		
				Sample	Sample	Spike	x
Date	Lab ID	Lab Fraction	Flag	Result	Result	Added	Recovery
Method: 10	P Metals	by \$46010					
Metrix: TA	EATED Sub	metrix: T					
Spiked Ana	ilyte: Sil	ver					
Type of Sp	ike = Met	hod Spike (Into Blank	·).				
04-Sep-90	9008204	0		0.00 mg/L	0.939 mg/L	1.000 mg/L	93.9
	Total N	umber of Spikes = 1			Selow acceptance =	0	
	Number	of Samples Used for S	itatistics = 1		Above acceptance =		
		Recovery = 93			Within acceptance =		
	Stander	d Deviation =			Acceptance Criteria	75.00 - 125.00	
Method: IC	P Metals	by \$16010					
Matrix: TR	EATED SUE	matrix: N/A					
Spiked Ana	lyte: Chr	onium					
Type of Sp	ike = Met	hod Spike (Into Blank	ο,				
28-S ep- 90	9009182	00		0.00 mg/Kg	0.856 mg/Kg	1.000 mg/Kg	85.60
Type of Sp	ike = mat	rix spike.					
26-Sep-90	9003399	210		954.0 mg/Kg	298.0 mg/Kg	110.0 mg/Kg	- 596.38
26-Sep-90	9008399	218		954.0 mg/Kg	512.0 mg/Kg	103.0 mg/≤g	429.1
3-0ct-90	9008204	03A		1640.0 mg/kg	3680.0 mg/Kg	2703.0 mg/Kg	75.4
3-0ct-90	9008204	02A		1640.0 mg/Kg	3920.0 mg/Kg	2778.0 mg/Kg	82.0
	Total N	umber of Spikes = 5			Below acceptance = 2	2	
	Number	of Samples Used For S	tatistics = 5		Above acceptance = (3	
	Hean I	Recovery =- 156			Within acceptance =	₹	

Standard Deviation = 330.58

Acceptance Criteria 75.00 - 125.90

Statistics calculated only for samples with a valid recovery.NC: Not Calculable

Table F6 (Continued)

Date	Lab ID	Lab Frection	Flag	Sample Result	Spiked Sample Result	Spike Added		Recovery
Method: I	P Metals	by \$46010						
Matrix: T	EATED Sub	matrix: N/A						
Spiked And	iyte: Iro	xn .						
Type of Sp	sike = Met	hod Spike (Into Blank						
28-Sep-90	9009+82	00		0.00 mg/Kg	8.550 mg/kg	10.0	mg/Kg	85.5
Type of Sp	ike = met	rix spike.						
26-Sep-90	9008379	218		116000 mg/Kg	31100.0 mg/Kg	1030.0	mg/Kg	- 8242.7
26-Sep-90	9008399	210		116000 mg/Kg	20700.0 mg/Kg	1100.0	mg/Kg	- 8663.64
3-0ct-90	9008204	OZA		104.0 mg/Kg	314.0 mg/Kg	231.5	mg/Kg	90.7
3-0ct-90	9008204	USA		104.0 mg/Kg	308.0 mg/Kg	255.2	mg/Xg	79.9
	Total N	umper of Spikes = 5			Below acceptance = 2	2		
		of Samples Used for S	tatistics = 5	i	Above acceptance = ()		
		Recovery =- 3330			Within acceptance =			
	Stander	d Deviation = 4679.	1		Acceptance Criteria	75.00 -	125.00	
lethod: IC								
		matrix: N/A						
ipiked Ana	lyte: Lem	d						
ype of Sp	ike = Het:	hod Spike (Into Stank).					
8-sep-90	9009182	00		0.00 mg/Kg	0.873 mg/Kg	1.000	mg/Kg	87.30
11-0ct-90	9009182	00		0.00 mg/Kg	0.471 mg/Kg	0.500	mg/Kg	94.20
ype of Sp	íke = met:	rix spike.						
6-Sep-90	9008399	210		110.0 mg/Kg	151.0 mg/kg	110.0	mg/Kg	37.27
6-Sep-90	9008399	218		110.0 mg/Kg	258.0 mg/Kg	103.0	mg/Kg	143.69
		mber of Spikes = 4			Below acceptance = 1			
		of Samples Used for S	tatistics = 4		Above acceptance = 1			
		scovery = 90	_		Within acceptance =	_		
	Standard	d Deviation # 43.53	3		Acceptance Criteria	75.00 -	125.00	

Statistics calculated only for samples with a valid recovery.AC: Not Calculable

Table F6 (Continued)

				*	Spiked			
				Sample	Sample	Spike		ı
Date	Lab 10	Lab Fraction	Flag	Result	Result	Added		Recovery
Method: IC	2 Hetals	by 546010	<u> </u>					
Matrix: TR	EATED SUE	matrix: N/A						
Spiked Ana	lyte: Nic	kei						
Type of Sp	ike = Met	hod Spike (Into Blank						
28-Sep-90	9009182	co		0.00 mg/Kg	0.850 mg/Kg	1.000	mg/Kg	85.0
01-0ct-90	9009182	00		0.00 mg/Kg	0.488 mg/Kg	0.500	mg/Kg	97.6
Type of Sp	ike = met	rix spike.						
26-Sep-90	9008399	210		16.8 mg/Kg	107.0 mg/Kg	110.0	mg/Kg	82.0
26-Sep-90				16.8 mg/Kg		103.0	-	88.5
03-0ct-90				20.2 mg/Kg	-· •			89.4
03-0ct-90	9008204	02A		20.2 mg/Kg	2920.0 mg/Kg	3241.0	mg/Kg	89.4
	Total H	umber of Spikes * 6			Below acceptance = ()	<u></u>	
	Xumber	of Samples Used For S	tatistics = 6	5	Above acceptance = ()		
	Hean X	Recovery = 85			Within acceptance *			
*********	nebnej? *******	d Deviation = 5.2	7 ************	**********	Acceptance Criteria		125.00	*********
Method: Se	lenium by	AA (E270.2)						
Matrix: So	•	•						
Spiked Ana	lyte: Sel	enium						
Type of Sp	íke = Pre	digestion Matrix Spik	•.					
27-Aug-90	9008041	co		0.00 mg/L	0.048 mg/L	0.050	mg/L	96.0
	Total H	umber of Spikes = 1			Below acceptance = ()		
	Number	of Samples Used For S	tatistics = 1	1	Above acceptance = 0)		
	Mean %	Recovery = 96			Within acceptance =	1		
		d Deviation =						

Table F6 (Continued)

Date	lab ID	Lab Fraction	Flag	Sample Result	Spiked Sample Result	Spike Added		Recovery
Method: S	elenium by	, AA (E270.2)			•			
Matrix: T	REATED SU	metrix: N/A						
Spiked An	slyte: Se	lenium						
Type of S	oike = Met	thod Spike (Into Blank	١.					
04-Sep-90	9008264	1		0.00 mg/Kg	0.485 mg/Kg	0.050	mg/Kg	976.80
05-Sep-90				0.00 mg/Kg	=	0.050	mg/Kg	100.00
06-Sep-90				0.00 mg/Kg		0.050	mg/Kg	100.00
	Total A	tumper of Spikes = 3			Below acceptance # 0			·
	Number	of Samples Used For S	tatistics = 3	i	Above acceptance = 1			
	Mean X	Recovery = 392			Within acceptance = 2			
	Standar	d Deviation = 506.2			Acceptance Criteria		125.00	**********
4825884421	*******	******************	***********	**********	******************			
Nethod: C	rome VI b	ry 5W7196						
Matrix: So	olid Subma	trix: T						
Spiked And	lyte: Chr	CRIUM VI						
Type of Sp	ike = met	rix spike.					÷	
06-Jul-90	9007040	198	RD	0.020 mg/L	0.104 mg/L	0.100	mg/L	94.00
06-Jul-90	9007040	228		0.347 mg/L	0.560 mg/L	0.200	mg/L	106.50
06-Jul-90	9007040	190	ND	0.020 mg/L	0.106 mg/L	0.100	mg/L	94.00
06-1nf-80	9007040	ZZC		0.347 mg/L	0.560 mg/L	0.200	mg/L	106.50
	Total N	umber of Spikes = 4			Below acceptance = 0			
	Number	of Samoles Used For S	tatistics = 4		Above acceptance = 0			
	Mean X	Recovery = 100			Within acceptance = 4	•		

Humber of Samples Used For Statistics = 4

Hean X Recovery = 100

Standard Deviation = 7.21

Acceptance = 4

Acceptance Criteria 75.00 - 125.00

Statistics calculated only for samples with a valid recovery.NC: Not Calculable

Table F6 (Continued)

		******************		Sample	Spiked Sample	Spike	x
Date	Lab ID	Lab Fraction	Flag	Result	Result	Added	Recovery
Method: C	rome VI b	ry \$47196					
Matrix: So	olid Subme	trix: N/A					
Spiked And							
Type of Sp	jíke = met	rix spike.					
22-Jul-90	5005247	100		18.2 mg/Kg	61.5 mg/Kg	49.2 mg/Kg	87.9
22-Jul-90	5005247	04A		3.100 mg/Kg	70.2 mg/Kg	60.8 mg/Kg	110.3
22-Jul-90	5005246	220		5.510 mg/Kg	69.4 mg/Kg	61.2 mg/Kg	104.3
22-141-90	5005247	040		3.100 mg/Kg	70.6 mg/Kg	60.8 mg/Kg	110.9
22-Jul-90	\$005246	22A		5.510 mg/Kg	69.0 mg/Kg	61.2 mg/Kg	103.6
22-Jul-90	5005247	10A		18.2 mg/Kg	61.2 mg/Kg	49.2 mg/Kg	87.2
26-Jul-90	9007040	03 a		27.4 mg/Kg	154.6 mg/Kg	126.7 mg/Kg	100.2
09-Jul-93	9007040	03C		27.4 mg/Kg	132.6 mg/Kg	119.3 mg/Kg	88.1
23-Aug-90	9008262	028		1,723 mg/Kg	6.122 mg/Kg	4.975 mg/Kg	88.4
23-Aug-90	9008262	CZC		1.723 mg/Kg	6.230 mg/Kg	5.000 mg/Kg	90.1
	Total N	umber of Spikes * 10			Salow acceptance =	0	
	Number	of Samples Used For	Statistics = 1	10	Above acceptance =	0	
	Mean X	Recovery = 97			Within acceptance	= 10	
	Standar	d Deviation = 9.	76		Acceptance Criteri	a 75.00 - 125.00	l
Method: Ch	rome VI b	y 5W7196					
Matrix: TR	EATED Sub	metrix: MW					
Spiked Ana	lyte: Chr	onium VI					
Type of Sp	ike = met	rix spike.					
29-Aug-90	9008327	198	<5X	0.079 mg/L	0.420 mg/L	0,400 mg/L	85.2
29-Aug-90	9005127	19C	<5 x	0.079 mg/L	0.408 mg/L	0.400 mg/L	82.2
11-5 ep-9 0	9008204	19C	NO	0.020 mg/L	MO 0.020 mg/L	0,400 mg/L	2.5
11-S ep-9 0	9008204	198	NO	0.020 mg/L	NO 0.020 mg/L	0.400 mg/L	2.5
9-5ep-90	9009103	198	ЖĎ	0.020 mg/L	1.010 mg/L	1.000 mg/L	100.0
9-5-9-90	9009103	19A	HÓ	0.020 mg/L	1.000 mg/L	1.000 mg/L	99.0
20-5 ep-9 0	9009182	148	MD	0.020 mg/L	0.199 mg/L	0.360 mg/L	52.5
10-Sep-90	9009182	14A	МО	0.020 mg/L	0.327 mg/L	0.360 mg/L	58,0
ype of Sp	ike = Pre	digestion Matrix Spil	ke.				

Statistics calculated only for samples with a valid recovery.NC: Not Calculable

Table F6 (Continued)

				Sample	Spiked Sample	Spike	*
Date	Lab ID	Lab Fraction	Flag	Result	Result	Added	Recovery
Method: 0	throme VI i	by 547196					
Matrix; T	REATED SU	ometrix: MV					
Analyte:	Chromium \	<i>t</i> 1					
Type of S	pike: Pred	digestion Matrix Spik	e. continued				
	Total I	lumber of Spikes = 9			Below acceptance = 3		
	Number	of Samples Used For 5	Statistics = 7	•	Above acceptance = 0		
		Recovery = 86			Within acceptance = 4		
	Standar	d Deviation = 16.9	21		Acceptance Criteria	75.00 - 125.00	
lethod: C	hrome VI b	ry SW7196					
latrix: T	REATED SUE	metrix: T					
ipiked An	elyte: Chr	onium VI					
'ype of S	pike = met	rix spike.					
9-Aug-90	9008327	080	<5X	0.068 mg/L	0.175 mg/L	0.100 mg/L	107.5
9-Aug-90	9008327	088	<5X	0.068 mg/L	0.175 mg/L	0.100 mg/L	107.0
3-Sep-90	9009045	13C	NO	0.020 mg/L	0.504 mg/L	0.500 mg/L	98.8
	9009045		NO	0.020 mg/L	0.506 mg/L	0.500 mg/L	99.2
,	9009011			0.689 mg/L	1.662 mg/L	1.000 mg/L	97.3
	9009011			0.689 mg/L	1.667 mg/L	1.000 mg/L	97.8
	9009103 9009103			0.182 mg/L 0.182 mg/L	0.511 mg/L 0.519 mg/L	0.360 mg/L 0.360 mg/L	91.3 93.6
	*						
		umber of Spikes = 8 of Samples Used for S	tatiatica = A		Below acceptance = 0 Above acceptance = 0		
		Recovery * 99			Within acceptance = 6		
		d Deviation = 5.5	9		Acceptance Criteria		
ethod: Ch	rome VI b	y 5¥7196					
atrix: TA	EATED Subs	metrix: N/A					
piked And	lyte: Chr	ORILIN VI					
ype of Sp	ike = And	lytical.					
5-Sep-90	9009011	03		0.103 mg/Kg	0.194 mg/Kg	0.099 mg/Kg	92.0
	9009011			8.034 mg/Kg	8.164 mg/Kg	2.558 mg/Kg	5.0
	9009045			17.9 mg/kg	18.8 mg/Kg	2.498 mg/Kg	33.9
7-Sep-90	9009103	04A		3.151 mg/Kg	5.483 mg/Kg	2.658 mg/Kg	87.9

Table F6 (Continued)

Date	Lab ID	Lab Fraction	Flag	Sample Result	Spiked Sample Result	Spike Added		% Recovery
Hethod: C	rome VI b	y SW7196						
Metrix: II	LEATED SUE	matrix: H/A						
Analyte: (hromium \	/1						
Type of Sp	ike: Meth	nod Spike (Into Blank). continued					
Type of Sp	oike = Met	thod Spike (Into Blan	k).					
06-Sep-90	9008204	0		0.00 mg/Kg	0,488 mg/Kg	0.500	ng/Kg	97.6
Type of Sp	ike = met	rix spike.						
23-Aug-90	9008204	02A	<5X	0.023 mg/Kg	0.074 mg/Kg	3.995	mg/Kg	1.2
23-Aug-90			<5X	0.023 mg/Kg			mg/Kg	1.5
10-Sep-90				4.158 mg/Kg			mg/Kg	81.8
10-Sep-90	9008399	084		4.158 mg/Kg		3.842	mg/Kg	75.5
Type of Sp	ike = Pro	edigestion Matrix Spi	ke.					
25-Sep-90	9009011	•		0.00 mg/Kg	0.160 mg/Kg	0.160	ng/Kg	100.0
	Total N	umber of Spikes = 10			Below acceptance =	4		
		of Samples Used For	Statistics = 6		Above ecceptance =	0		
		Recovery = 69			Within acceptance =			
********	Stander	d Devistion = 63.	56	********	Acceptance Criteria	75.00 -	125.00	
	-	IC (E300.0)						
		trix: N/A						
Spiked Ana	iyte: Sul	fate						
Type of Sp	ike = met	rix spike.						
10-101-90	9007040	03C		995.5 mg/Kg	6545.5 mg/Kg	6369.4	mg/Kg	88.3
10-Jul-90	9007040	038		995.5 mg/Kg	6623.9 mg/Kg	6369.4	ang/Kg	88.3
14-Sep-90	9008262	068		4815.1 mg/Kg	17534.1 mg/Kg	12987.0	mg/Kg	97.9
14-Sep-90	9008262	06 c		4815.1 mg/Kg	18415.3 mg/Kg	12987.0	mg/Kg	104.7
	Total N	c per of Spikes = 4			Below acceptance =	0		
	Number	of Samples Used For	Statistics = 4		Above acceptance *	0		
	Hean X	Recovery = 94			Within acceptance =	4		

Statistics calculated only for samples with a valid recovery.MC: Not Calculable

Table F6 (Concluded)

Date	Lab ID	Lab Fraction	Flag	Cample Result	Spiked Sample Result	Spike Added		% Recovery
Method: St	ilfate by	IC (E300.0)						
Matrix: T	REATED SUE	metrix: N/A						
Spiked And	ilyte: Sul	fate						
Type of Sp	oike = And	ilytical.						
03-0ct-90	9009103	OSA		999.4 mg/Kg	13922.6 mg/Kg	13171.4	mg/Kg	98.12
Type of Sp	ike = met	rix spike.						
14-Sep-90	9008284	02A		9760.0 mg/Kg	22048.0 mg/Kg	12500.0	mg/Kg	98.30
14-Sep-90	9008399	08A		5900.0 mg/Kg	19125.3 mg/Kg	13053.0	mg/Kg	101.32
14-Sep-90	9008204	03A		9760.0 mg/Kg	24444.0 mg/Kg	12500.0	mg/Kg	117.47
14-Sep-90	9008399	07A		5900.0 mg/Kg	19009.8 mg/Kg	13053.0	ed∖≾ā	100.44
	Total N	umber of Spikes	. 5		Selow acceptance = 0			
	Kumber	of Samples Used I	or Statistics = 5	i	Above acceptance = 0			
	Hean I	Recovery = 103			Within acceptance = 1	5		
	Stander	d Deviation =	8.13		Acceptance Criteria	80.00 -	120.00	

Statistics calculated only for samples with a valid recovery.NC: Not Calculable

Table F7

Precision Estimates by Source of Variability, Frontier Hard Chrome

MARIN - MU FP LEACHATE: Submatrix = N/A

Matrix = MU EP LEACHATE; Submatrix = N//	**************	· · · · · · · · · · · · · · · · · · ·		122222222222222	Pooled
	# of	Range	e of	Pooled	CV CV
Parameter	Pairs	Hea	'4	SD.	
Chromium by ICPES					
Field Duplicate	4	0.0010 -	0.074 mg/L	0.00	45.5
Chromium	4	0.0030	4.014 11314		
iron by sub010					
field Duplicate			0.705 mg/L	0.25	49.3
(ron	4	0.093 -	0.103 "-372		
ICP Metals by SW6010					
Analytical Dup (At Instrument)		WO -	0.119 mg/L	0.03	25.1
Chronium	5 5	0.180 -	1.325 mg/L	0.12	20.0
lron	4	un -	ND	NC	NC
Lead	ž	NO -	ND	NC	NC
Nickel	•	***			
Matrix Spike Duplicate				10.61	9.9
Chromium	1	107.5 -		27.58	25.7
iron	1	107.5 -	107.5 mg/L	2,83	3.0
Lead	1	95.8 -	95.8 mg/L 99.5 mg/L	1.41	1.4
Nickel	1	99.5 -	yy,3 mg/L		
Nickel by SU6010					
Field Duplicate		0.015	0.015 mg/L	0.00	0.0
Nickel	4	• ເເມ,ນ	u.u.s neg/t		
Lead by SW6010					
Field Duplicate	4	0.062 -	0.042 mg/L	0.00	0.0
Lead	•	U.U.Z	0.000		

NC: Not Calculable

Table F7 (Continued)

Matrix = SOLID; Submatrix = MV

#####################################	*************	***********	****************	********
	# of	Range of	Pooled	Pool ed
Parameter	Pairs	Heans	SO	CA
Chrome VI by SW7196				
Analytical Dup (At Instrument)				
Chromium VI	2	жо -	NO NC	NC
Field Duplicate				
Chromium VI	3	ND -	NO NC	NC
Predigestion Duplicate				
Chromium VI	4	ND - 0.00	38 mg/L 0.00	47.1

NC: Not Calculable

Table F7 (Continued)

Hatrix * SOLID; Submetrix * T

建筑建筑设计划设计器运用设计器设计设计设计设计设计设计设计设计设计	*********	*********	************	*******
	# of	Range of	Pooled	Pooled
Parameter	Pairs	Keans.	\$50	CY
Chrome VI by SW7196				
Analytical Dup (At Instrument) Chromium VI	2	NO - 7.273 mg/L	0.05	0.7

MC: Not Calculable

Table F7 (Continued)

Matrix = SOLID; Submatrix = N/A

######################################	# of	Ran	ge of		Pooled	Pooled
Parameter	Pairs		iens		\$0	CA
Chronium by ICPES						
Field Duplicate					14.03	8.5
Chromium	10	9.800 -	550.0	mg/Ag	14.45	
Chromium by ICPES						
Field Duplicate						45.5
Chronium	4	0.0030 -	0.074	mg/Kg	0.00	43.3
Chloride by IC (E300.0)						
' Analytical Dup (At Instrument)			2/0.4	//-	16.52	6.4
Chloride	1	280.1 -	260.1	ng/xg	10.52	
Matrix Spike Duplicate						
Chloride	1	83.5 -	83.5	mg/Kg	0.83	1.0
Iron by \$46010						
Field Duplicate						• •
1ron	10	6400.0 -	39500.0	mg/Kg	2554.60	8.9
Iran by \$46010						
Field Duplicate						49.3
tron	4	0.093 -	0.705	mg/Kg	0.25	49.3
ICP Metals by SW6010						
Anelytical Dup (At Instrument)	-				13.99	22.2
Chromium	7 7	0.080 -	36700.0		5013.54	20-6
Iron Lead	7	7.625 -		mg/kg mg/Kg	3.99	21.5
Nickel	7		34.9		2.90	19.0
Matrix Spike Duplicate						

NC: Not Calculable

Table F7 (Continued)

Matrix = SOLID; Submatrix = N/A

	# of	Rane	e of		Pooled	Poole
Parameter	Pairs	Жe	ens		20	CA
Chronium	16	53.0 -	150.9	mg/Kg	50.41	45.3
Iron	5	77.3 -		mg/Kg	10.51	12.9
Lead	16	19.9 -	372.2	mg/Kg	34.67	36.0
Nickel	14	86.6 -	111.5	mg/Kg	11.70	11.8
Percent moisture inorganic						
Field Duplicate						
Percent moisture	10	4.000 -	39.2	mg/Kg	2.73	15.0
lickel by \$W6010						
Field Duplicate						
Nickei	10	6.100 -	32.5	mg/Kg	3.29	18.4
licket by SN6010						
Field Duplicate						
Nickel	4	0.015 -	0.015	mg/Kg	0.00	0.0
ead by \$46010						
Field Duplicate						
Lead	10	7.050 -	280.0	mg/Kg	4.75	16.9
ead by SW6010						
Field Duplicate						
Leed	4	0.042 -	0.042	mg/Kg	0.00	0.0
hrome VI by SW7196						
Analytical Dup (At Instrument)						
Chromium VI	22	жо -	23.0	mg/Kg	0.34	36.5
Field Dublicate						

NC: Not Calculable

Table F7 (Continued)

Matrix = SOLID; Submatrix = N/A

**************************	**********	**********	********	*********	**********	*********
	# of	Rac	ge of		Pooled	Pooled
Firameter	Pairs	Ke	ans		SO.	CA
Chronium VI	7	ж0 -	47.9	mg/Kg	1.58	41.8
Matrix Spike Duplicate						
Chromium VI	6	87.6 -	110.6	mg/Kg	3.53	3.7
Predigestion Duplicate						
Chronium VI	1	0.063 -	0.063	mg/Kg	0.05	84.9
Sulface by IC (E300.0)						
,						
Analytical Dup (At Instrument)					1.73	0.0
Sulfate	1	4816.3 -	4816.3	mg/Kg	1.73	0.0
Matrix Spike Duplicate						
Sulface	1	88.4 -	88.4	mg/Kg	0.00	0.0

NC: Not Calculable

Table F7 (Continued)

Matrix = TREATED; Submatrix = My

	************	**********	******	222227F	**********	*******
	# of	Rans	e of		Pooled	Pooled
Parameter	Pairs	Ме	ins		\$0	CV
ICP Metals by SW6010						
Analytical Dup (At Instrument)					•	
Chromium	1	0.090 -	0.090	mg/L	0.07	83.3
Iron	1	0.637 -	0.637	mg/L	0.38	59.1
Lead	1	NO -	MQ		NC	HC
Mickei	1	NO -	МО		NC	NC
Chrome VI by SW7196						
Analytical Dup (At Instrument)						
Chromium VI	4	ND -	0.080	mg/L	0.04	77.9

MC: Not Calculable

Table F7 (Continued)

Matrix = TREATED; Submatrix = T

\$\$\$\$\$\$ * * * * * * * * * * * * * * * *	*************	************	**********	********	2.本本本本立立文明本本立:
Parameter	# of Pairs	Range of Means		Pooled SD	Pooled CV
Conductivity (E120.1) Analytical Dup (At Instrument) Conductivity	2	7655.0 - 30150.	0 umhos/cm	150.08	0.5
H by SU9945 Analytical Dup (At Instrument) pH	1	5.014 - 5.01	4 mg/L	0.00	0.1
nrome VI by SW7196 Analytical Dup (At Instrument) Chromium VI	7	MD - 0.69	1 mg/L	6.01	6.8

HC: Not Calculable

Table F7 (Continued)

Matrix = TREATED; Summetrix = M/A

	# of	Ran	ge of		Pool ed	Pooled
Parameter	Pairs	He	ene		SD	CA
Conductivity (E120.1)						
Analytical Dup (At Instrument)						
Conductivity	2	1995.0 -	2600.0	umhos/cm	11.18	0.5
Chloride by IC (E300.0)						
Analytical Dup (At Instrument)						
Chloride	1	85.3 -	85.3	mg/Kg	11.08	13.0
Matrix Spike Duplicate						
Chloride .	5	93.2 -	95.6	mg/Kg	2.96	3.2
ICP Metals by SW6010						
Matrix Spike Duplicate						
Chromium	3	-512.7 -	92.0	mg/Kg	68.33	13.8
tron	2	-8453.2 -	85.3	mg/Kg	210.53	6.8
Lead	1	90.5 -		ng/Kg	75.25	83.2
Nickel	2	85.3 -	89.4	mg/Kg	3.27	3.8
of by SN9045						
Analytical Dup (At Instrument)						
рн	1	11.2 -	11.2	mg/Kg	0.00	0.0
hrome VI by SW7196						
Analytical Dup (At Instrument)						
Chromium VI	4	NO -	7.106	mg/Kg	0.12	4.9
Matrix Spike Duplicate						
Chromium VI	6	1.414 -	107.0	mg/Kg	2.03	5.5

NC: Not Calculable

Table F7 (Concluded)

Matrix = TREATED; Submatrix = H/A

医医性性性 医克里氏 医克里氏 医克里氏 医克里氏 医克里氏 医克里氏 经股份 医克里氏 医克里氏 医克里氏 医克里氏 医克里氏 医克里氏 医克里氏 医克里氏	*************		*==**********	**********	**********
	# of	Ran	ige of	Pooled	Pooled
Parameter	Pairs	Же	ans	\$0 	CV
Sulface by IC (E300.0)					
Analytical Dup (At Instrument)					
Sulfate	2	703.0 -	944.0 mg/kg	64.64	7.5
Matrix Spike Duplicate					
Sulfate	2	100.9 -	107.9 mg/Kg	9.59	8.9

(Continued)

Table F8
Detailed Duplicate Results, Frontier Mard Chrome

	Routine Sample 10	Dupticate Sample 10	= -	Routine Value		Duplicate Value	Hean Concentration	Deviation	RPD (X)
Method: Chromium by 1CPES									
Type = field Duplicate				:		210 0	CROO C	0.0071	125.0
Chromium	S00518703A	\$00518704A	-	0.0030 mg/L		0.013 mg/L	0.0000	00004	3 8 6
en imount	\$00\$18902A	\$00516904	-	0.0010 mg/L	Ş	0.0040 mg/L	0.0035	0.00071	0.03
	C005180104	S00518915A	_	0.0030 mg/L		0.0030 mg/L	0.0010	0.00	0.00
Chromium	\$00518921A	\$00518922A		0.059 mg/L		0.078 mg/L	9.074	0.0064	12.2
Hethod: 1CP Metals by SW6010									
Type * Analytical Dup (At Instrument)	nstrument)					;	6	00	00.00
Chromina	\$00518904	500518905		U.0040 mg/L		0.0040 mg/L	0.00		3
	\$00\$18002	\$00518903	뎣	0.0030 mg/L	ã	0.0030 mg/L	읒	¥	ا ر ا کا
Chromitan	2006 1002	100813003		0.075.00/1		0.160 mg/L	0.119	0.058	63.6
Chromium	30011005	102818002	ś	0.0030 ma/1	9	0.0030 mg/L	01	S)	N.C
Chromium	00/01/02002	012/202003	}	0 080 mg/t		0.079 mg/L	0.080	0.00071	1.258
Chromium	200704729	0010000		2 (500.00		•			
	702013003	£005 18707		1/04 017 0		0.420 mg/L	0.425	0.0071	2.353
rou	200218708	200015005		0 160 mo/1		0.200 mg/L	0,180	0.028	22.2
Iros	200218002	200512005		0.860 mg/t		1.200 mg/L	1.030	0.240	33.0
Iron	200316005	804704005		110 4071		1.340 mg/L	1.325	0.021	5.264
Iron	\$00518925	\$20071005		0.230 mg/L		0.380 mg/l	0.305	0.106	49.2
	1.004.1004	700512002	9	1/54 270 0	2	0.042 mg/L	Q N	S.	Ä
Lead	200011000	500619005	9	1/04 270 U	9	0.042 mg/L	9	Ϋ́	S S
lead	500518904	100613002	9	0.07.2 40.1	9	0.042 mg/L	Q	N.	JH.
Lead	200218902	Sun Suns	2	4/Eu 350.0	È		9	5	υ X
lead	\$00\$18706	\$00518707	9	0.042 mg/L	2	0.042 mg/L	ž	ł	!
•	A07.81.200.2	500518707	9	0.015 trq/L	ð	0.015 mg/L	Q.	S.	Ä
Nickel	מסים כחסיב	10101000	!!	17 year	Š		9	ЖC	SK
Rickel	\$00518994	\$00518905	2	0.015 avg/L	2		Š	!	

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Table F8 (Continued)

DUPLICATE (SAMPLES OR ANALYSES) FOR MATRIK = MA EP LEACHATE; Submatrik = W/A

Nickel 500518902 Mickel 500518922 Type = Matrix Spike Duplicate Chromium 500518910A Iron 500518910A	2 \$00518903 2 \$00518923						
. Natrik Spike Duplicate Lm		0.0 O.0	0.015 mg/L N	ND 0.015 mg/L	ON C	2	S .
* Matrix Spike Duplicate					Q.	ų X	Š
ai ca							
	3A \$00518911A	115	115.0 mg/L	100.0 mg/L	107.5	10.6	14.0
	JA \$00516911A	82	88.0 mg/L	127.0 mg/L	107.5	27.6	36.3
	JA \$00518911A	16	97.8 ng/L	93.8 mg/L	95.8	2.828	4.175
Micket \$00518910A	JA \$005 18911A	100	100.5 mg/L	98.5 mg/L	\$.%	1.414	2.010
Method: from by SW6010							
Type = field Duplicate							
		9.0	0.650 mg/L	0.760 mg/L	0.705	0.078	15.6
		0.1	0.160 mg/L	0.860 mg/L	0.510	0.495	137.3
	A \$00518915A	0.0	0.099 mg/L	0.086 34/1	C.093	0.0092	14.1
1ron \$00518921A	1A \$00518922A	0.2	0.200 mg/L	0.230 mg/L	0.215	0.021	14.0
Method: Lead by Su6010							
* field Buplicate							
Lead \$00518902A	2A \$00518904A	0.0	0.042 mg/L	0.042 mg/L	0.042	0.00	0.00
		0.0	0.042 mg/L	0.042 mg/L	0.042	0.00	00.0
		0.0	0.042 mg/L	0.042 mg/L	0.042	0.00	0.00
Lead \$00518919A	PA \$00518915A	0.0	0.042 mg/L	0.042 mg/L	0.042	0.00	00.00

Table F8 (Continued)

DUPLICATE (SAMPLES OR ANALYSES)	TSES) FOR MATRIX	FOR MATRIX = MU EP LEACHATE; Submatrix = N/A	Submatrix = N/A				
Par backer	Routine Sample 1D	Duplicate Sample 10	Routine Duplicate Routine Duplicate Mean Standard Somple 10 Sample 10 Value Concentration Deviation RPD (X)	Duplicate Value	Mean Mean Concentration	Standard	RPD (X)
Nethod: Nickel by \$46010 Type = Field Duplicate Nickel Nickel	\$00\$18703A \$00\$18703A \$00\$18919A	\$00518704A \$00518922A \$00518915A \$005189015A	0.015 mg/L 0.015 mg/L 0.015 mg/L 0.015 mg/L	0.015 mg/L 0.015 mg/L 0.015 mg/L 0.015 mg/L	0.015 0.015 0.015 0.015	0.00 0.00 0.00 0.00	0.00 0.00 0.00

Table f8 (Continued)

DUPLICATE (SAMPLES OR ANALYSES) FOR MATRIX = SOIL; SLAmatrix = MJ

	Routine	Dupl fcate		Routine Duplicate Routine Duplicate Hean sandard		Duplicate	He B	Standard	
	Sample 10	Sample 10		Value		Value	Concentration	Deviation	RP0 (X)
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1									
Hettiod: Lintone VI by SU/156	•								
Type " Analytical Day (At Instrument)	Instrument)								
Chrosius VI	102391	002391	9	0.0050 mg/L	9	0.0050 mg/l	ş		;
Chromina VI	002151	002151	ð	0.0050 mg/L	9	0.0050 mg/L	9	2 12	
1,Tw = field Duplicate									
Chronium VI	002231	002233	2	0.0050 mg/L	g	0.0050 maz	ş	ş	;
Chronium VI	179200	002643	9	0.0050 mg/t	S	0 0050 000	} {	2 (؛ د
17 11 11				- 1 m	Ì	1/64 OCOO.0	2	ر *	S S
	002481	002HB3	ş	0.0050 mg/L	9	0.0050 mg/L	Q.	S.	Ä
Type * Predigestion Duplicate	ate								
Chromium VI	002381	002381	ð	0.0050 mg/L	9	0.0050 mg/L	Ş	2	į
Chronium VI	002541	002541		0.0050 mg/L	2	0.0050 mg/l	9	2 5	ב ב
Chronius VI	002641	002641	9	0,0050 mg/L	9	0.0050 2071	2 5	2 1	ָ
Chronium VI	002#81	002483	윷	0.0050 mg/L	2	0.0050 mg/L	2 9		. u

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Table F8 (Continued)

DUPLICATE (SAMPLES OR ANALYSES) F	SES) FOR MATRIX	FOR MATRIX = SOIL; Submatrix = I	T = XI	特別維持 计标准 计放送机 化水质溶液	***************************************		FOR MATRIX = SOIL; Submatrix = I		**************************************
Psconter	Routine Sample ID	Duplicate Sample 10	~ -	Routine		Dupticate	Concentration	Deviation	8PD (X)
Method: Chrome VI by Su7196 Type * Analytical Dup (At Instrum: Chromium VI Chromium VI 900	Instructor) 900704031 900704006	900704031	ð	0.020 mg/L 7.238 mg/L	3	0.020 mg/L 7.308 mg/L	мD 7.273	NC 0.050	NC 0.967

Table f8 (Continued)

DUPLICATE (SAMPLES OR ANALYSES) FOR MATRIX # SOIL; Submatrix = N/A

· 医医克勒氏试验检检检检检检检检检检检检检检检检检检检检检检检检检检检检检检检检检检检检		"我就没有我的,""""""""""""""""""""""""""""""""""""""	******	7 机回向性 化氯化苯酚 化二甲基苯酚 医二甲基苯酚 医二甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基甲基	***	阿拉伯斯拉拉斯拉拉拉拉拉拉斯拉斯拉拉	医非对抗性眼神神经现代 医克克特氏 医外部 医多种性性 医多种性 医多种性 医多种性 医多种性 医多种性 医多种性 医多种	对	
	Koutine	Dupi icate	•	Routine		Dupl icate	Hean	Standard	
	Sample 10	Sample 10		Value		Value	Concentration	Deviation	RPD (X)
Method: Chloride by IC (£300.0)	.0)								
Type * Analytical oup (At Instrument)	nstrument)								
Chloride	900B26206A	9008262068		248.4 mg/Kg		271.8 mg/Kg	260.1	16.5	5.982
Type - Matrix Spike Ouplicate	į.								
Chloride	9007040038	900704003C		84.1 п9/Кв		82.9 mg/Kg	83.5	0.831	1.408
Method: Chrone VI by SU7196									
Type * Analytical Dup (At Inst	nstrument)								
Chronium VI	001121	001121		0.490 mg/Kg		0.490 mg/Kg	0.490	0.00	0.00
Chronium VI	001511	001511	윷	0.070 mg/Kg	2	0.070 mg/Kg	Q	Ş) X
Chronium VI	001161	001161		0.730 mg/Kg		0.600 mg/Kg	0.665	0.092	19.5
Chronium VI	001611	001611	9	0.060 mg/Kg		0.160 mg/Kg	Ģ	N	Ü
Chromium VI	129100	001621	9	0.060 mg/Kg	묫	0.060 mg/Kg	QX	S	Ü
Chroniun VI	001181	001483		1.360 mg/Kg		1.440 mg/Kg	1.400	0.057	5.714
Chronium VI	001651	001661		1.310 mg/Kg		0.730 mg/Kg	1.020	0.410	56.9
Chromium VI	001731	001731		0.220 mg/Kg		0.220 mg/Kg	0.220	0.00	0.00
Chromium VI	17/100	001741		6.980 mg/Kg		6.980 mg/Kg	980.9	0.00	00.00
Chromiun VI	001831	001831		0.120 mg/Kg		0.120 mg/Kg	0.120	00.00	00 0
Ehromium VI	001861	001861		3.170 mg/Kg		4.140 mg/Kg	3.655	0.686	
Chronium VI	117100	117100	9	0.050 mg/Kg	윷	0.050 mg/Kg	QN.	N.C.	×
Chromium VI	001331	001331		0.100 mg/Kg		0.100 mg/Kg	0.100	0.00	0.00
Chronium VI	001161	001161		23.7 mg/Kg		22.4 mg/Kg	23.0	0.919	5.640
Larontun VI	001341	001341	3	0.060 mg/Kg		0.100 mg/Kg	9	KC	S S
Chronium VI	001351	001351	9	0.070 mg/Kg	욮	0.070 mg/Kg	Ş	NC	Ä
Chronium VI	001381	001381	9	0.070 mg/Kg	Q	0.060 mg/Kg	Q	N.C	N
Chronium VI	001411	001411	9	0.050 mg/Kg	9	0.050 mg/Kg	Q	N.C	ž
Chromium VI	001621	125100	9	0.060 mg/Kg	9	0.060 mg/Kg	Q	NC.	SK
MC: Not Calculable									

Table F8 (Continued)

DUPLICATE (SAMPLES OR ANALYSES) FOR MATRIX = SOIL; Submatrix = M/A

Paraneter	Routine	Dupl scare		Rout ine		Duplicate	Mean	Standard	
	Sample 10	Sample 10		Value		Value	Concentration	Deviation	RPD (X)
Chronium VI	001431	001431	9	0.060 mg/Kg	2	0.060 mg/Kg	NO	NC	SE C
Chromium VI	156100	156100		0.710 mg/Kg		0.710 mg/Kg	0.710	0.00	00.00
Chromican VI	127100	127100	9	0.070 mg/Kg	ð	0.0070 mg/kg	Q N	Ŋ.	ĸ
Type = Field Duplicate									
Chromium VI	186100	001934		0.320 mg/Kg		0.350 mg/Kg	0.335	0.021	8.955
Chromium VI	001851	001863		3.170 mg/Kg		2.380 mg/Kg	2.775	0.559	28.5
Chromium VI	001641	001643		0.160 mg/Kg	ş	0.070 mg/Kg	Q	S S) N
Chronium VI	001171	001173	Ģ	0.140 mg/Kg	9	0.140 mg/Kg	ON.	SH.	Q.
Chronium VI	001641	001643		16.5 mg/Kg		17.5 mg/Kg	17.0	0.686	\$.708
Chronium VI	001171	271100		50.3 mg/Kg		45.5 mg/Kg	6.7.9	3.408	10.1
Chronium VI	177100	001473	2	0.070 mg/Kg	9	0.080 mg/Kg	Q	HC	J NC
Type = Hatrix Spike Duplicate	Ţ.								
Chromium VI	S00524622A	2005246220		105.7 mg/Kg		104.3 mg/Kg	104.0	0.485	0,660
Chromium VI	8610702006	900704019C		94.0 mg/Kg		94.0 mg/Kg	0.76	0.00	0.00
Chromium VI	900704003B	900704003C		100.3 mg/Kg		88.1 mg/Kg	5.76	8.613	12.9
Chronium VI	9007040228	9007040220		106.5 mg/Kg		106.5 mg/Kg	106.5	0.00	0.00
Chromium VI	S00524710A	\$005247100		87.2 mg/Kg		87.9 mg/Kg	87.6	625.0	0.789
Chromium VI	\$00524704A	8005247040		110.3 mg/Kg		111.0 mg/Kg	110.6	0.488	97970
Type * Predigestion Duplicate	.								
Chronium VI	001331	001331		0.100 mg/Kg	Q	0.050 mg/Kg	92	N.C	Ä
Method: Chromium by 1CPES									
Type a Field Duplicate									
Chronium	\$00518919A	\$00518915A		0.0030 mg/Kg		0.0030 mg/Kg	0.0030	0.00	00.0
Chromiun	S00518425A	\$00518414A		15.0 mg/kg		17.0 mg/Kg	16.0	1.414	12.5
Chromium	\$00518902A	\$00518904A		0.0030 mg/Kg	Ş	0.0040 mg/Kg	0.0035	0.00071	28.6

Table F8 (Continued)

DUPLICATE (SAMPLES OR ANALYSES) FOR MATRIX = SOIL; SLETARLTIN = M/A

	Routine	Dupt Icate	Routine	Dupl Icate	Kean	Standard	
	Sample 10	Sample 10	Value	Value	Concentration	Deviation	RPD (X)
Chromium	\$00518409A	\$00518416A	11.0 mg/Kg	12.0 mg/Kg	11.5	707	¥ 404
Chronium	S00514921A	\$00518922A	0.069 mg/Kg	0.078 mg/Kg	0.074	9900.0	2,57
Chromica	S00515929A	\$00515955A	9.600 mg/Kg	10.0 mg/Kg	9.830	0.283	7:3.
Chromius	\$00518608A	S00518609A	160.0 mg/Kg	170.0 mg/Kg	165.0	7.07	9 9
Chronium	\$00515903A	\$00515953A	14.0 mg/Kg	16.0 mg/Kg	16.0	2.828	25.0
Chromium	\$00\$15924A	\$00515954A	86.0 mg/Kg	100.0 m./Kg	93.0	6.8%	15.1
Chronium	S00518435A	\$005 18436A	34.0 mg/Kg	30.0 mg/Kg	32.0	2.828	12.5
Chromica	\$00\$18703A	\$00518704A	0.0030 mg/Kg	0.013 mg/Kg	0.0000	0,0071	125.0
Chromium	S00518515A	S00518617A	520.0 mg/Kg	580.0 mg/Kg	550.0	42.4	10.9
Chromiun	S00519016A	\$500519018.4	14.0 mg/Kg	19.0 mg/Kg	18.5	0.707	5.405
Chronium	800519026A	\$00519029A	49.0 mg/Kg	50.0 mg/Kg	\$.9.5	0.707	2.020
Method: ICP Metals by Su6010							
Type * Analytical Dup (At Ins	At instrument)						
Chronium	500518436	500518437	29.8 mg/Kg	21.4 mo/10	9 %	363 7	. 76
Chronium	\$10519018	\$00519019	19.1 mg/Kg	22.1 mg/Kg	20.6	2.121	16.6
Chromium	\$00518609	\$00518610	170.0 mg/Kg	170.0 mg/Kg	170.0	00.0	00.0
Chronium	\$00518617	\$00518618	\$79.0 mg/Kg	630.0 mg/Kg	\$ 707	<u> </u>	22.7
Chromium	\$12005	\$00518417	12.4 mg/Kg	12.5 mg/Kg	12.5	0.071	0.803
Chrowium	\$1,721,5005	500518415	16.8 mg/Kg	7.400 mg/Kg	12.1	6.647	1.11
Chromium	\$00704725	\$00704726	0.080 mg/Kg	0.079 mg/Kg	0.080	0.00071	1.258
Iron	\$00518416	\$00518417	16600.0 mg/Kg	13600.0 mg/Kg	15100.0	2121.3	10.0
Iron	\$20,707.00\$	\$00704726	11700.0 mg/Kg	11700.0 mg/Kg	11700.0	0.00	0.00
Irea	\$00518617	\$1981500\$	25800.0 mg/Kg	44600.0 mg/Kg	36700.0	11172.3	43.1
lr.es	\$00518436	200518437	29900.0 mg/Kg	27400.0 mg/Kg	28650.0	1767.8	8.726
lron	\$1001500\$	\$10615005	6720.0 mg/Kg	7280.0 mg/Kg	7000.0	396.0	B.000
rs.	\$005 184 14	500518415	17500.0 mg/Kg	9710.0 mg/Kg	13605.0	5508.4	57.3
Iron	\$00518609	500518610	29900.0 mg/Kg	35000.0 mg/Kg	32450.0	3606.2	15.7

Table FB (Continued)

X = 11/A
; Submatr
* SOIL;
FOR MATRIX
ã
ANAL YSES)
8
(SAMPLES
DUPLICATE (SAMPLES OR ANALYSES)

\$00519018 \$00516416 \$00516416 \$00516414 \$00516417 \$00516617 \$00516416 \$00516	417 417 418 418 410 726	7.380 mg/kg 44.8 mg/kg 31.5 mg/kg 22.2 mg/kg 40.4 mg/kg 31.4 mg/kg 12.1 mg/kg	7.870 mg/kg 4.38 mg/kg 25.3 mg/kg 35.4 mg/kg 32.7 mg/kg 12.4 mg/kg 12.4 mg/kg 13.5 mg/kg	7.625 46.3 28.4		
\$00519018 \$00518416 \$00518416 \$00518416 \$00518617 \$00518617 \$00518617 \$00518416 \$00518617 \$00518416 \$00518416 \$00518416 \$00518416 \$00518416 \$00518416 \$00518416 \$005184258 \$005184258 \$007047018 \$007047018 \$007047018 \$007045128 \$007045128 \$007045128		7.380 mg/kg 44.8 mg/kg 31.5 mg/kg 22.2 mg/kg 40.4 mg/kg 12.1 mg/kg 17.4 mg/kg	~	7.625 46.3 28.4 16.1		
\$00516416 \$00516436 \$00516436 \$00516417 \$00516416 \$00516416 \$00516416 \$00516416 \$00516416 \$00516416 \$00516416 \$00516416 \$00516416 \$00516418 \$00516413 \$00516425 \$00516425 \$00516425 \$00516425 \$00516425 \$00516425 \$00516425 \$00516403 \$00704703 \$00704703 \$00704503 \$00704503 \$00704503		44.8 mg/kg 31.5 mg/kg 22.2 mg/kg 40.4 mg/kg 31.4 mg/kg 12.1 mg/kg 12.1 mg/kg	•	46.3 28.4 16.1	0.346	9.459
\$00518436 \$00518414 \$00518414 \$00518617 \$00518617 \$00519018 \$00519416 \$00519416 \$00518414 \$00518414 \$00518414 \$00518416 \$00518416 \$00518416 \$00518416 \$00518418 \$00518418 \$00518417 \$00518417 \$00518417 \$00518418 \$00518418 \$007047018 \$007047184 \$007046128 \$007046128 \$007046128		31.5 mg/kg 22.2 mg/kg 40.4 mg/kg 31.4 mg/kg 12.1 mg/kg 17.4 mg/kg	•	28.4	2.121	6.479
\$00518414 \$00518414 \$00518617 \$00518617 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$00704003A \$0		22.2 mg/kg 40.4 mg/kg 31.4 mg/kg 12.1 mg/kg 5.970 mg/kg	•	16.1	4.385	21.8
\$00518617 \$00518609 \$00704725 \$00704725 \$00519018 \$00519416 \$00518414 \$00518414 \$00518414 \$00518414 \$00518414 \$00518414 \$00518417 \$00518425 \$00518425 \$00518425 \$00518425 \$00518425 \$00518425 \$00704707 \$007047134 \$007047134 \$007047104	618 610 726 019	40.4 mg/kg 31.4 mg/kg 12.1 mg/kg 5.970 mg/kg	35.4 mg/Kg 32.7 mg/Kg 12.4 mg/Kg 6.240 mg/Kg 13.5 mg/Kg		8.627	75.5
\$00518609 \$00704725 \$00704725 \$00519018 \$00516416 \$00516414 \$00516414 \$00516414 \$00516414 \$00516417 \$005164725 \$005164254 \$007047034 \$007047034 \$007047034 \$007047134 \$007047134 \$007047134 \$007047134 \$007047104	610 726 019	31.4 mg/kg 12.1 mg/kg 5.970 mg/kg 37.4 mg/kg	32.7 mg/kg 12.4 mg/kg 6.240 mg/kg 13.5 mg/kg	37.9	3.536	13.2
\$00704725 \$00719018 \$00519018 \$00519018 \$00519414 \$00518414 \$00518414 \$00518414 \$00518414 \$00518414 \$00518414 \$00018	726	12.1 mg/Kg 5.970 mg/Kg 17.6 mg/Kg	12.4 mg/kg 6.240 mg/kg 13.5 mg/kg	32.1	0.919	4.056
\$00519018 \$00516416 \$00516416 \$00516416 \$00516416 \$00516416 \$00516416 \$00516416 \$00516416 \$00516416 \$00516416 \$00516418 \$00516425 \$00516428 \$005047018 \$007047018 \$007047018 \$007045128 \$007046128 \$007046128 \$007046128 \$007046128 \$007046028 \$00	610	5.970 mg/Kg	6.240 mg/Kg 13.5 mg/Kg	12.3	0.212	5.449
\$00516416 \$00518414 \$00518414 \$00518414 \$00518436 \$00518436 \$00518436 \$00518436 \$005184254 \$005184254 \$007040034 \$007047034 \$007047134 \$007047134 \$007047134 \$007047134 \$007046124 \$107046094		17 6 mg/Ya	13.5 mg/Kg	6.105	0.191	4.423
\$00518414 \$00518414 \$00518409 \$00518409 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$00704725 \$007046094 \$007	417	# 17 P		. 15.6	5.899	26.4
\$00516609 \$00704725 \$00704725 \$00518436 \$00516617 \$00516617 \$005164254 \$007040034 \$007047034 \$007047134 \$007047134 \$007047134 \$007047104 \$007046128 \$007046128	415	10.1 mg/Kg	9.030 mg/Kg	12.6	4.999	56.3
\$00704725 \$00518436 \$00518617 \$00518617 \$005186254 \$007040034 \$007047034 \$007047134 \$007047134 \$007047134 \$007046124 \$007046124 \$007046124 \$007046124 \$007046124 \$007046124	610	19.6 mg/Kg	24.9 mg/Kg	22.3	3.748	23.8
\$00518436 \$00518617 \$00518617 \$00518617 \$005186254 \$007040034 \$007047074 \$007047134 \$007047134 \$007046124 \$007046124 \$007046124 \$007046124 \$007046124 \$007046124 \$007046124	726	10.7 mg/Kg	11.2 mg/Kg	11.0	0.354	4.566
\$00516617 **Hatrix Spike Duplicate \$005164254 **Lan \$00704003A \$00704707A \$00704703A \$00704713A **Lan \$00704713A \$00704713A **Lan \$00704612A	437	22.0 mg/Kg	17.3 mg/Kg	19.6	3.324	23.9
strix Spike Duplicate S00516425A 900704003A S00704707A S00704713A S00704713A S00704710A S00519027A	818	35.1 mg/Kg	34.7 mg/Kg	34.9	0.283	1.146
\$00516425A 900704003A \$00704707A \$00704713A \$00704713A \$00704713A \$00704710A \$0070451902A						
900704707A \$00704707A \$00704707A \$00704713A \$00704512A \$00704512A \$00704612A \$00704612A \$00704602A	H250	95.9 mg/Kg	91.7 mg/kg	93.8	2.977	4.489
\$00704707A \$00704713A \$00704701A \$00704501A \$00704710A \$005706700A \$00519027A	0038	93.6 mg/Kg	85.8 mg/Kg	89.7	5.501	8.676
\$00704713A \$00704701A \$00704612A \$00704612A \$00704609A \$00519027A	707	101.7 mg/Kg	112.6 mg/Kg	107.1	7.712	10.2
\$00704701A \$00704612A \$00704612A \$00704609A \$00519027A	7130	85.3 mg/Kg	79.9 mg/kg	82.6	3.816	6.530
\$00704612A \$00704710A \$00704609A \$00519027A	7015	86.1 mg/Kg	118.8 mg/Kg	102.5	23.2	32.0
\$00704710A \$00704609A \$00519027A	613A	107.9 mg/Kg	9.938 mg/Kg	58.9	69.3	166.3
\$00704609A \$00519027A	7100	53.7 mg/Kg	52.2 mg/Kg	53.0	1.107	2.956
\$00519027A	610A	156.4 mg/Kg	82.6 mg/Kg	119.5	52.1	61.7
	0028A	193.6 mg/Kg	108.3 mg/Kg	150.9	60.3	\$9.5
Chromium 900/0402.A 900/0402.B	9220	97.9 mg/Kg	97.9 mg/Kg	6.79	00.0	00.0
Chromium \$00704716A \$007047160	7160	154.9 mg/Kg	106.1 mg/Kg	145.5	55.8	27.75
Chrumium 900704019A 900704019B	.019a	95.9 mg/Kg	96.9 mg/Kg	9.96	0.707	1.037

MC: Not Calculable

Table FB (Continued)

DUPLICATE (SAMPLES OR ANALYSES) FOR MATRIX = SOIL; Submatrix = N/A

	Routine Somple 10	Duplicate Somple 10	Routine	Duplicate Mean Standard Value Concentration Deviation RPD (X)	Mean Concentration	Standard Deviation	RP0 (X)
Chronium	\$007007008	0701701005	104.5 mg/Kg	117.1 mg/Kg	110.8	8.906	11.4
Chromita	\$0051C410A	S00518411A	93.9 mg/Kg	103.7 mg/Kg	8.86	6.962	\$96.6
Chromiun	\$00704615A	S00704616A	61.7 ng/Kg	189.3 mg/Kg	125.5	2.06	101.7
Chromica	\$00518605A	5005186050	240.2 mg/Kg	53.2 mg/Kg	146.7	132.2	127.5
100	900704022A	9007040228	100.5 mg/Kg	99.5 mg/Kg	100.0	707.0	1.000
2	\$00704701A	S00704701D	97.0 mg/Kg	67.9 mg/Kg	82.4	20.5	35.2
Iron	S00704710A	\$007047100	69.4 mg/Kg	85.2 mg/Kg	77.3	11.2	20.5
Iron	S00704716A	2007047160	89.9 mg/Kg	92.0 mg/Kg	91.0	1.465	2.277
Iron	900704019A	9007040198	96.8 mg/Kg	94.8 mg/Kg	8.8	1.414	2.088
100	900704003A	90070706	18.4 mg/Kg	21.4 mg/Kg	19.9	2.150	15.3
7	\$00704713A	\$007047130	95.9 mg/Kg	90.9 mg/Kg	93.4	3.570	\$.404
7 6 9 1	\$00704710A	\$007047100	48.6 mg/Kg	49.4 mg/Kg	0.67	0.542	1.564
9	\$00515934A	\$00515935A	2.439 mg/Kg	149.6 mg/Kg	75.0	104.1	193.6
Lead	\$00\$15938A	\$00515939A	101.1 mg/Kg	102.3 mg/Kg	101.7	0.633	1.158
1007	\$00\$24727A	\$00524728A	431.8 mg/Kg	312.6 mg/Kg	372.2	84.3	32.0
Lead	\$00704615A	\$00704616A	74.1 mg/Kg	77.8 mg/Kg	75.9	2.603	4.848
resd	\$00518410A	\$00518411A	72.9 mg/Kg	119.0 mg/Kg	95.9	32.6	1.82
Des. 1	900704019A	9007040198	64.7 mg/Kg	89.9 mg/Kg	89.3	0.849	1.344
pesal	\$00518635A	\$005186050	113.5 mg/Kg	116.8 mg/Kg	115.1	2.340	2.874
l co-1	\$00518425A	\$005164250	97.1 mg/Kg	91.1 mg/Kg	1.76	4.254	6.393
Lead	S00704612A	\$00704613A	87.2 mg/Kg	80.7 mg/Kg	83.9	765.7	7.742
Lead	\$00704609A	S00704610A	117.3 mg/Kg	100.7 mg/Kg	109.0	11.6	15.2
1.694	S00519027A	S00519028A	103.9 mg/Kg	100.3 mg/Kg	102.1	2.602	3.605
Lead	\$00519009	\$005 190 10A	98.3 mg/Kg	102.8 mg/Kg	100.5	3.193	767.7
tread	\$0070402A	900704028	92.3 mg/Kg	94.3 mg/Kg	93.3	1.414	2.144
1400	\$00515934A	\$00515935A	64.8 mg/Kg	98.0 mg/Kg	9.16	9.309	14.4
U (1)	\$00704713A	5907047130	89.1 mg/Kg	58.0 mg/Kg	88.6	0.786	1.255

NC: Not Calculable

Table FB (Continued)

DUPLICATE (SAMPLES OR ANALYSES) FOR MATRIX = SOIL; SULMARTIX = N/A

Parameter	foutine	Dupticate	Routine	Dupl feate	Kea	Standard	
	Sample 10	Sample 10	Value	Vatue	Concentration	Deviation	RPD (X)
Hickel	\$005 15938A	\$00\$15939A	105.3 mg/Kg	105.3 mg/Kg	105.5	0.314	0.420
Hickel	\$00\$24729A	\$00\$24730A	90.3 mg/Kg	132.8 mg/Kg	111.5	30.0	38.0
Wickel	\$00524727A	\$00524728A	101.0 mg/Kg	109.6 mg/Kg	105.3	6.102	8.197
Nickel	S00524725A	\$00\$24726A	106.3 mg/Kg	73.5 mg/Kg	6.06	24.6	38.3
Nickel	900704003A	9007040038	97.7 mg/Kg	75.6 mg/Kg	86.6	15.7	25.6
Hickel	\$00518410A	S00518411A	101.2 mg/Kg	100.2 mg/Kg	100.7	0.715	1.004
Hickel	900704019A	9007040198	93.4 mg/Kg	96.4 mg/Kg	6.76	2.121	3.161
Nickel	S00518425A	\$005184250	103.9 mg/Kg	104.9 mg/Kg	104.4	0.689	0.933
Nickel	\$00518625A	\$005186050	98.6 mg/Kg	94.8 mg/Kg	7.76	1.296	1.876
Hickel	\$00519027A	\$00519028A	103.0 mg/Kg	101.3 mg/Kg	102.1	1.210	1.676
Hickel	\$00519009A	\$00519010A	97.6 mg/Kg	105.7 mg/Kg	101.7	5.726	7.503
Nickel	\$00704022A	9007040228	95.8 ng/Kg	96.1 mg/Kg	85.9	0.212	0.313
Method: 1 ron by \$u6010							
Type a Field Duoi Care							
Troo	\$0051500S	\$005150564	24000 0 00045	TION G POLKS	275.00 0	£ 6707	3 %
Loa	\$1005 S	\$00518922A	0.200 mg/Kg	0.230 ad/kg	0.215	0.021	14.0
	\$00518919.5	S00518915A	0.099 mg/Kg	0.086 mq/Kg	0.093	2600.0	14.1
Iron	S00515929A	\$00515955A		7600.0 mg/Kg	7400.0	282.8	5.405
fron	\$00518902A	\$00518904A	0.160 mg/Kg	0.860 mg/Kg	0.510	95.0	137.3
Iron	S00518703A	S00518704A	0.650 mg/Kg	0.760 mg/Kg	0.705	0.078	15.6
Iron	\$00518608A	\$00518509A	33000.0 mg/Kg	30000.0 mg/Kg	31500.0	2121.3	9.524
£15	\$00\$ 19026A	\$00519029A	25000.0 mg/Kg	26000.0 mg/Kg	25500.0	107.1	3.922
Iron	\$00518425A	\$00518414A	16000.0 mg/Kg	15000.0 mg/Kg	17000.0	1414.2	11.8
Iron	\$005 19016A	\$00519018A	6100.0 mg/Kg	6700.0 mg/Kg	0.0079	454.3	9.375
tron	\$00513409A	S00518416A	15003.0 mg/Kg	16000.0 mg/Kg	15500.0	1.707	6.452
Iron	\$00\$18435A	\$00518436A	\$1000.0 mg/Kg	30000.0 mg/Kg	30500.0	107.1	3.279
Iron	\$00518515A	\$00516617A	25000.0 mg/Kg	29000.0 mg/Kg	27000.0	2828.4	14.8
Iron	\$0051500S	S00515953A	36000.0 mg/Kg	43000.0 mg/Kg	39500.0	1.0767	17.71

	Routine Sample 1D	Ouplicate Sumple 10	ě	Routine Value		Duplicate Vatue	Hean Concentration	Standard Deviation	RPD (X)
Method: Lead by \$146010									
Type = field Duplicate								į	
,	S00518435A	S00518436A		35.0 mg/Kg		32.0 mg/Kg	33.5	2.121	6.93
	\$00519026A	S00519029A	Ś	31.0 mg/Kg	ς Σ	30.0 mg/Kg	30.5	0.707	3.279
7 7	S00518705	\$00518704A		0.042 mg/Kg		0.042 mg/Kg	0.042	00.00	0.00
7.0	C005180218	\$00\$18922A		0.042 mg/Kg		0.042 mg/Kg	0.042	00.00	0.00
	COP5 18913A	S00518015A		0.042 mg/Kg		0.042 mg/Kg	0.042	0.00	00.00
769	AA10012002	\$005 190 1 AA	SX.	5.700 mg/Kg	\$\$	7.400 mg/Kg	7.050	0.495	626.6
7	200212002	\$00\$18609A	;	31.0 mg/Kg		31.0 mg/Kg	31.0	0.00	0.00
,	\$005 180024	\$1005180064		0.042 mg/Kg		0.042 mg/Kg	0.042	0.00	0.00
	\$15051500S	\$005159544		56.0 mg/Kg		61.0 mg/Kg	58.5	3.536	8.547
	500518.15a	S00518617A		17.0 mo/Kg		40.0 mg/Kg	36.5	2.121	7.792
,	\$005 184 25A	\$11791 5005	5 5	19.0 mg/Kg	\$\$	22.0 mg/Kg	20.5	2.121	14.6
	C005184098	S00518416A		43.0 mg/Kg		45.0 mg/Kg	0.77	1.414	4.545
	\$00515005	\$0051500S	×5×	7.100 mg/Kg	\$\$	7.700 mg/Kg	7.400	0.424	8.108
Lead	*************	************				180 0 200/10	280.0	141.4	7.17
ادما	\$00\$1\$903A	\$00\$1\$953A		Sau.u mg/kg		54 /PM 0.001			
dethod: Wickel by SW6010									
Type - Field Duplicate				;			3 21	0 102	74.3
Joket	\$00515008	\$00515953A		11.0 mg/Kg		8 4 / full 0 : \$7	310		00 0
Wickel	2005139021	S00518904A		0.015 mg/Kg		U.U. mg/kg	0.0.0	20.0	
	\$005 18608A	S00518609A		23.0 mg/Kg		20.0 mg/Kg	21.5	2.121	0.41
· · · · · · · · · · · · · · · · · · ·	\$005190264	S00519029A		20.0 mg/Kg		20.0 mJ/Kg	20.0	0.00	0.00
	S00518435A	S00516436A		24.0 mg/Kg		22.0 mg/Kg	23.0	1.414	3.696
	S00515924A	\$00515954A		24.0 mg/Kg		24.0 mg/Kg	24.0	0.00	0.00
ונונו				277		0.015 200/70	0.015	0.00	0.0
		470/WIGOUS		24/25		# / P			

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(Continued)

Table F8 (Continued)

DUPLICATE (SAMPLES OR ANALYSES) FOR MATRIX . SOIL; SLEMMATELX . N/A

Parameter Routine Duplicate Routine Duplicate Mean Standard en ex	Routine	Duplicate	<u>.</u>	Routine		Duplicate	Hean	Standard	2
	Sample 10	Sample 10	>	Value		A. D. C.	Concentration	Deviation	Kro (A)
Wickel	\$00513615A	\$005 18617A		30.0 mg/Kg		35.0 mg/Kg	32.5	3.536	15.4
	A510915002	\$005190184	Ś	6.800 mg/Kg	\$ \$	6.000 mg/Kg	007.9	9.566	12.5
· · · · · · · · · · · · · · · · · · ·	\$10518921A	\$00518922A		0.015 mg/Kg		0.015 mg/Kg	0.015	0.00	0.00
	\$00518409A	\$005 184 16A		16.0 mg/Kg		18.0 mg/Kg	17.0	1.414	11.8
, — — — — — — — — — — — — — — — — — — —	\$005 18425A	S00518414A		14.0 mg/kg		16.0 mg/Kg	15.0	1.414	13.3
Nickel	\$00518919A	\$00518915A		0.015 mg/Kg		0.015 mg/Kg	0.015	0.00	0.00
Method: Percent moisture inorganic	inorganic								
Type . Hield Duplicate								•	ć
Percent moisture	\$00519016A	\$005190184		21.6 mg/Kg		21.6 mg/Kg	51.6	0.00	0.0
Percent moisture	\$00515924A	\$00\$15954A		32.2 mg/Kg		28.6 mg/Kg	30.4	5.546	B
Percent moisture	\$00\$19026A	\$00519029A		39.3 mg/Kg		39.1 mg/Kg	39.2	0.141	0.510
Percent animates	\$00518435A	S00518436A		26.3 mg/Kg		26.0 mg/Kg	26.2	0.212	1.147
Percent moisture	\$00518608A	\$00518609A		27.3 mg/Kg		28.0 mg/Kg	27.7	0.495	2.532
	\$00\$1842\$A	S00518414A		23.0 mg/Kg		11.7 mg/Kg	17.4	7.990	65.1
	8008184184	\$00518617A		30.1 mg/xg		28.8 mg/Kg	29.5	0.919	4.414
	\$00\$18700S	\$00518416A		4.100 mg/Kg		3.900 mg/Kg	000.4	0.141	2.000
	\$00\$15029	\$00\$15955A		23.1 mg/Kg		21.6 mg/Kg	22.4	1.061	6.711
Percent molsture	\$00515903A	\$30515953A		26.6 mg/Kg		28.5 mg/Kg	27.6	1.344	6.697
	į								
Method: Suffere by 1C (£169.0)	103.03								
Type - Analytical Dup (At Instrument) Sulfate 900d262	At Instrument) 900826206A	9008262068		4815.1 mg/Kg		4817.5 mg/Kg	4816.3	1.732	0.051
Type * Matrix Spike Duplicate				27		7 10	7 6	0.00	0.00
Sulfate	9007040036	Y00704003C		55.4 mg/kg		60. • mg/kg	;)) •	

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			Standard	Deviation
			Kean	د اه
			Duplicate	Value
rix * N/A	经基金银矿 不足足 医医乳腺性 医乳体 医红红色色 化氯化	1 1 4	WORLING.	Value
= SOIL; Submet.	*****	Bouries Duckless	2000	Sample 10 Sample 10
LES OR AMALYSES) FOR MATRIX = SOIL; Submetrix = N/A	(Sout ins	2	Sample 10
CUPLICATE (SAMPLES OR ANA	对外循环阵阵 计注册设计 对比 动物 网络种种 医甲状腺 医甲状腺	Paraneter		

RP0 (X)

Table F8 (Continued)

							超特社的银铁的复数形式使光起的复数形式 经收益股份 医多种性 医多种性 医多种性 医多种性 医多种性 医多种性 医多种性 医多种性	3.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1	
Parameter	Routine Sample 10	Duplicate Sample 10	•	Routine Value	_	Duplicate Value	Mean Concentration	Standard Deviation	RPO (X)
Meihod: Chrome VI by \$W7196									
Type = Analytical Dup (At Instrument)	strument)	9008204100	g	0.020 mg/t	9	0.020 mg/L	Q.	Ų,	S
in aming a	000813710	900812719	, X,	0.080 mg/L	9	0.020 mg/L	ç	Ñ	ž
	616018000	900819919	\$\$X	0.083 mg/L	45 X	0.077 mg/L	0.080	0.0042	7.500
Chromium VI	900918214A	9009182148	9	0.020 mg/L	9	0.020 mg/L	9	N.	ŭ
Hethod: ICP Hetals by \$16010									
Type = Analytical Dup (At Insirument) Chromium 9009103	900910310A	900910310A		0.037 mg/L		0.143 mg/L	0.090	0.075	117.8
Iron	900910310A	900910310A		0.903 mg/L		0.371 mg/L	0.637	0.376	63.5
Peal	900910310A	900910310A	9	0.050 mg/L	윷	0.050 mg/L	QN	Ŋ,	ň
Nickel	900910310A	900910310A	ğ	0.026 mg/L	9	0.026 mg/L	ç	2	N.C

Table F8 (Continued)

DUPLICATE (SAMPLES OR ANALYSES) FOR MATRIX = TREATED; Submatrix = T

Paraneter	Routine Sample ID	Duplicate Souple 10		Routine Value		Parameter Routine Buplicate Routine Buplicate Mean Standard Sample 10 Sample 10 Value Value Concentration Deviation RPO (X)	Nean Concentration	Standard Deviation	RPD (X)
Method: Chrome VI by Su7196									
Type a Analytical Bup (At Instrument)	nstrument)								
Chromium VI	9008204158	900820415C	윺	0.020 mg/L	ð	0.020 mg/L	오	KC	Ä
Chronium VI	9008204158	900820415C	9	0.020 mg/L	9	0.020 mg/L	Q	¥	N.
Chronium VI	\$11106004	900901113		0.689 mg/L		0.693 mg/L	0.691	0.0028	0.579
Chromius VI	900832708	900832708	Ş	0.068 mg/L	¥¢\$	0.071 mg/L	0.070	0.0021	4.317
Chromium VI	900904513	900904513	ğ	0.020 mg/L	Š	0.020 mg/L	NO.) H	Ж
Promium VI	900904517	900904517		0.127 mg/L		0.103 mg/L	0.118	0.013	16.2
Chronium VI	900910319A	900910319A	9	0.020 mg/L	Š	0.020 mg/l	QV.	ñ	#C
Method: Conductivity (E120.1)	•								
Type * Analytical Dup (At Instrument)	nstrument)								
Conductivity	900639915	\$100£300Q		7650.0 unhos/cm		7660.0 umbos/cm	7655.0	7.071	0.131
Contactivity	\$15706006	\$00904513		30300.0 umbos/cm		30000.0 unthos/cm	30150.0	212.1	0.9%5
Method: pit by SU9045 Type a analysical him (at instrument)	Ostriment)								
£	900910319A	900910319A		5.017 mg/L		5.010 mg/L	5.014	0.0049	0.140

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Table F8 (Continued)

Parameter	Routine Sample 1D	Dupticate Sompte 10	•	Routine Value		Dupi Icate Value	Kean Concentration	Standard Deviation	8P0 (X)
Method: Chloride by 1C (E300.0) Type = Analytical Dup (At Instrument) Chloride	.0) nstrument) 900918206A	9009182068		77.4 mg/Kg		93.1 mg/Kg	85.3	<u> </u>	18.4
Type = Matrix Spike Dupilcate Chloride Chloride	re . Jasopoza 900820402A	90083990BA 900820403A		90.6 mg/Kg 94.2 mg/Kg		95.8 mg/Kg 97.0 mg/Kg	93.2 93.6	3.687 1.980	5.596
Method: Chrome VI by SU7196 Iype * Analyticul Dup (At Instrument) Chromium VI 9009045 Chromium VI 90090111 Chromium VI 9009182 Chromium VI 9009182	900904504 900904504 900901103 900918201A	900904504 90091103 90091103	2 2	7.012 mg/Kg 1.689 mg/Kg 0.080 mg/Kg 0.080 mg/Kg	9 9	7.200 mg/Kg 1.536 mg/Kg 0.080 mg/Kg 0.080 mg/Kg	7.106 1.613 MD	0.133 0.108 NC	2.646 9.488 NC
Type - Hatrix Spike Duplicate Chrowlon VI Chromium VI Chromium VI Chromium VI Chromium VI Chromium VI Chromium VI	900420402A 90042041138 9005204198 9003127058 9008127198	900820403A 900901113C 900820419C 900832706C 900832719C		1.294 mc/Kg 97.3 mg/Kg 2.500 mg/Kg 107.0 mg/Kg 81.8 mg/Kg 85.3 mg/Kg		1.534 mg/kg 97.8 mg/kg 2.500 mg/kg 107.0 mg/kg 75.5 mg/kg 82.3 mg/kg	1.414 97.6 2.500 107.0 78.7 83.8	0.170 0.354 0.00 0.00 4.467 2.121	17.0 0.513 0.00 0.00 0.00 8.029
Method: Coxductivity (E120.1) Type * Analytical Dup (At Instrument) Coxductivity Coxductivity 90090459	Instrument) 900839906 900904504	9008139906		2000.0 umhos/cm 2590.0 umhos/cm		1990.0 umhos/cm 2610.0 umhos/cm	1995.0	17.071	0.501

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Table F8 (Concluded)

DUPLICATE (SAMPLES OR ANALYSES) FOR MATRIX = TREATED; Submatrix = M/A

Parameter Routine Duplicate Routine Duplicate Mean Standard Sample ID Value Concentration Deviation RPD (X)	Routine Sample 10	Duplicate Sumple 10	Routhe	Dup! icate Value	Read Concentration	Standard Deviation	RP0 (X)
Method: ICP Metals by SW6010							
Type * Matrix Spike Duplicate							
Chronium	9008399218	900839921C	91.5 mg/Kg	92.5 mg/Ku	95.0	0.707	1.087
Chrosium	9006399218	900839921C	-429.1 mg/Kg	-596.4 mg/Kg	-512.7	116.3	-32.6
Chronium	900820402A	9008204B3A	82.1 mg/Kg	75.5 mg/Kg	78.8	4.668	8.381
17.8	900820402A	900820403A	90.7 mg/Kg	79.9 mg/Kg	85.3	7.619	12.6
Ira	9008399218	9008399210	-8242.7 mg/Kg	-8663.6 mg/Kg	-8453.2	297.6	- 5.0
lesd	9004399218	9008399210	143.7 mg/Kg	37.3 mg/Kg	\$0.5	73.2	117.6
Hicket	9008399218	9006399210	88.5 mg/Kg	82.0 mg/Kg	85.3	4.627	7.674
Micket	900820402A	900820403A	69.5 mg/Kg	89.4 mg/Kg	9.69	0.038	0.061
Hethod: Sulfate by (C (E300.0)							
Type = Analytical Dup (At Instrument)	(trument)						
Sulfate	900918206A	900918206A	669.7 mg/Kg	736.3 mg/Kg	703.0	1.73	9.474
Sulfate	\$009104009	\$00910306A	999.4 mg/Kg	888.6 mg/Kg	0.44.0	78.5	11.7
fype * Matrix Spike Duplicate							
Sulfate	900839907A	9004339908A	100.4 mg/Kg	101.3 mg/Kg	100.9	0.626	0.877
Sulfate	900820402A	900820403A	98.3 mg/Kg	117.5 mg/Kg	107.9	13.6	17.8
<pre>Rethod: pH by SWPU45 Type * Analytical Dup (At Instrument)</pre>	strument)						
	900910306A	900910306A	11.2 mg/Kg	11.2 mg/Kg	11.2	0.00071	0.00%

Waterways Experiment Station Cataloging-In-Publication Data

Fleming, Elizabeth C.

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