TECHNICAL MEMORANDUM - PHASE I TREATABILITY STUDY OF BIOSLURRY TREATMENT TECHNOLOGY

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IT PROJECT NO. 408491

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List of Acronyms

Acronym	*Title*
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
BAC	Biotechnology Applications Center
BSRT	biological solids retention time
BTX	Benzene, toluene, xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CFU/g	Colony forming unit per gram
CLP	Contract Laboratory Program
C:N:P	Carbon:Nitrogen:Phosphorous Ratio
cm^3/min	cubic centimeter/minute
CPAH	carcinogenic polycyclic aromatic hydrocarbon
Eimco	Eimco Process Equipment Company
EPA	U.S. Environmental Protection Agency
FID	flame ionization detector
ft	foot
g	gram
GC/MS	Gas Chromatograph/Mass Spectrometry
GC	Gas Chromatograph
HPLC	high performance liquid chromatography
HRT	hydraulic retention time
IT	IT Corporation
ITAS	IT Analytical Services
KMCC	Kerr-McGee Chemical Corporation, Inc.
l	liter
l/day	liters per day
lb	pound
mg/kg	milligrams per kilogram

List of Acronyms (continued)

Acronym	*Title*
mg/l	milligrams per Liter
mg/l -hr	milligrams per Liter - hour
mg	milligram
ml/min	milliliter per minute
ml	milliliter
mm	millimeter
N	Normal
NIOSH	National Institute of Occupational Safety and Health
NPL	National Priorities List
nm	nanometer
PAH	polycyclic aromatic hydrocarbons
QA	Quality Assurance
QC	Quality Control
RAS	return activated sludge
RI/FS	remedial investigation/feasibility study
rpm	Revolutions Per Minute
ROD	Record of Decision
scf/hr	standard cubic feet per hour
SOP	Standard Operating Procedure
SOW	Statement of Work
TC	total carbon
TOC	Total Organic Carbon
TS	total solids
UV	Ultraviolet
VOC	volatile organic compound
VS	volatile solids
WAS	waste activated sludge
Weston	Roy F. Weston, Inc.

Executive Summary

Roy F. Weston, Inc. (Weston), prime contractor to Kerr-McGee Chemical Corporation, Inc. (KMCC), contracted IT Corporation (IT) to conduct Phase I laboratory-scale treatability studies. The purpose of these studies was to evaluate the effectiveness of bioslurry treatment technology in treating creosote-impacted soils from the Moss-American site, located in Milwaukee, Wisconsin. The treatability studies were conducted as part of Predesign Task 16 of the U.S. Environmental Protection Agency's (EPA's) Statement of Work (SOW). The subject SOW requires treatment of the contaminants of concern (i.e., total carcinogenic polycyclic aromatic hydrocarbons [CPAH]) to 6.1 milligrams per kilogram (mg/kg).

The Phase I treatability studies for bioslurry treatment included a batch slurry study and a bioslurry reactor study. The batch slurry study produced supporting data for the enhanced operation of the laboratory-scale bioslurry reactor. Batch slurry testing was conducted in sealed, 1-liter (l) vessels at solids loadings of 30 and 40 percent. The duration of the batch study was 6 weeks with sample analysis during initiation, Week 3, and Week 6. The objectives of this study included:

- Providing support data for enhanced operation of bioslurry reactor
- Determining the impact of solids loading on operation
- Calculating preliminary substrate utilization rates.

Depending on the treatment vessel analyzed, the batch study demonstrated total polycyclic aromatic hydrocarbons (PAH) percent removals ranging from 83 to 87 percent; CPAH removals ranged from 71 to 79 percent. Maximum substrate removal occurred during the first 3 weeks of operation. Initial PAH concentrations in the six treatment vessels ranged from 1,100 to 1,600 mg/kg; CPAH concentrations ranged from 390 to 550 mg/kg. The average PAH concentrations following 3 weeks of operation was 320 mg/kg. The CPAH concentrations were reduced to 170 mg/kg at Week 3. No significant change in PAH or CPAH concentrations were measured during the following 3 weeks of operation.

Substrate utilization rates in the batch study during the first 3 weeks of operation averaged 0.041 mg PAH/gram (g) Total Solids (TS)/day in the 30 percent treatments and 0.052 mg PAH/g TS/day in the 40 percent treatments. CPAH removal rates averaged 0.012 mg

CPAH/g TS/day in the 30 percent treatments and 0.016 mg CPAH/g TS/day in the 40 percent treatments during the first 3 weeks of operation.

Although the CPAH substrate removals in the 30 and 40 percent treatments were similar, the physical nature of the 40 percent slurry would not allow for sufficient mixing. A maximum slurry density of 35 percent was determined to be appropriate for suspension in the bioslurry reactor during an initial slurry evaluation conducted by Eimco Process Equipment Company (Eimco). Therefore, a 30 percent solids loading was chosen for bioslurry reactor operation.

During the 3-month bioslurry study, a 60-l, stainless-steel, Eimco Biolift™ slurry reactor was operated in continuous-flow and batch mode. Operation of this unit under the optimum solids loading determined during batch testing provided performance data to determine the feasibility of meeting the specified treatment standard. The objectives of the bioslurry investigation included:

- Estimation of hydraulic retention time (HRT) and biological solids retention time (BSRT) set points for operation
- Determination of the efficacy of meeting the specified treatment standard
- Identification of requirements for additional physical/chemical pretreatment
- Generation of performance data upon which pilot-scale design can be established.

Continuous-flow bioreactor operation was maintained for a 10-week period. Average PAH and CPAH percent removals based on concentration during the first 4 weeks of operation were 67 and 33 percent, respectively. Following the first 4 weeks of operation, analytical results suggest that bioreactor performance decreased. The last 6 weeks of continuous-flow operation demonstrated increasing PAH and CPAH concentrations in the effluent stream.

Batch operation was initiated and maintained for the remaining 5 weeks of operation. Reactor batch operation demonstrated average PAH and CPAH percent removals of 17 and 27 percent, respectively.

PAH and CPAH concentrations in the bioslurry averaged 320 and 180 mg/kg, respectively, during the first 4 weeks of operation. The PAH concentration increased during the following 6 weeks of operation. Batch operation of the reactor resulted in PAH and CPAH concentrations of 720 and 200 mg/kg, respectively.

Overall, neither batch nor bioslurry reactor studies produced final CPAH concentrations near the mandated treatment goal of 6.1 mg/kg.

1.0 Introduction

1.1 Site Description

U.S. Environmental Protection Agency (EPA), pursuant to Section 105 of the 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), placed the Moss-American site in Milwaukee, Wisconsin (the Facility) on the National Priorities List (NPL). The Facility is located in the northwestern section of the City of Milwaukee, County of Milwaukee, State of Wisconsin, at the southeast corner of the intersection of Brown Deer and Granville Roads, at 8716 Granville Road. The Facility, as defined by the Consent Decree (CD), includes the former Moss-American wood preserving plant property and approximately 5 miles of the Little Menomonee River. The Little Menomonee River flows through the eastern portion of the former wood preserving plant, continuing on through the Milwaukee County Parkway, to its confluence with the Menomonee River about 5 miles south. Portions of the Little Menomonee River's floodplain are included in the Facility boundary. Fifty-one acres of the former wood preserving plant is undeveloped Milwaukee County park land. Twenty-three acres is owned by the Chicago and North Western Transportation Company and used as a loading and storage area for automobile transport. The Facility is located in a moderately-populated suburban area of mixed industrial, commercial, residential, and recreational use. Population in the nearby area is estimated at 2,036 persons per square mile.

Prior Removal and Remediation Activities

EPA conducted a remedial investigation/feasibility study (RI/FS) for the Facility and issued the corresponding RI and FS reports on January 9, and May 24, 1990, respectively.

On May 29, 1990, EPA published a notice of completion for the RI/FS and issued the proposed Remedial Action Plan for the Facility. A public comment period began with issuance of the proposed plan and extended until August 6, 1990. On September 27, 1990, the EPA Regional Administrator signed the Record of Decision (ROD), which describes the Remedial Action Plan for the Facility. Public comments that were received and EPA response to the comments were included in the ROD, with which the State of Wisconsin has expressed concurrence.

A CD incorporating the Statement of Work (SOW) was signed by Kerr-McGee Chemical Corporation, Inc. (KMCC) on July 17, 1991. The CD was lodged by the U.S. Department of Justice on December 28, 1991. Under this CD, the Settling Defendant, KMCC, will lead in developing and implementing the Remedial Design and Remedial Action Plan for the Facility.

Roy F. Weston, Inc. (Weston) is the prime contractor to the Settling Defendant, KMCC, responsible for the CD implementation. Weston contracted IT Corporation (IT) to conduct Phase I laboratory-scale treatability studies to evaluate the effectiveness of the bioslurry treatment technology in treating creosote-impacted soils at the Facility. The treatability studies were conducted as part of Predesign Task 16 of the SOW. Initial characterization data for treatability study test matrix determined during Predesign Task 16 is included in Appendix A.

1.2 Waste Description

The polycyclic aromatic hydrocarbon (PAH) components of creosote; benzene, toluene, xylene (BTX); and carcinogenic polycyclic aromatic hydrocarbons (CPAH) were the site contaminants of concern. According to the RI, the maximum PAH concentration was 32,000 milligrams per kilogram (mg/kg). Maximum CPAH concentration was approximately 1,900 mg/kg. The CPAH concentrations averaged 300 to 400 mg/kg. The SOW requires treatment of contaminated site soils and sediments to 6.1 mg/kg of total CPAH.

Site soil samples employed during the continuous-flow bioslurry reactor study had average CPAH and PAH concentrations of approximately 250 and 1,000 mg/kg, respectively. PAH concentrations ranged from 720 to 1,200 mg/kg. The CPAH fraction ranged from 200 to 300 mg/kg.

1.3 Remedial Technology Description

The primary remedial treatment alternative chosen by EPA for implementation at the Facility is biological slurry treatment. The selection of a remedial treatment alternative was driven by compliance with the mandated cleanup criterion. The treatment standard for the soil and sediment was 6.1 mg/kg of the CPAH fraction of the creosote contamination, specifically, chrysene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g-h-i)perylene, dibenz(a,h)-anthracene, and indeno(1,2,3-c,d)pyrene. These

compounds are characterized by high organic partition coefficients (K_{ow}), low aqueous solubility, and low vapor pressures (Table 1-1).

Bioremediation of the CPAH in soils and sediment may utilize bioslurry reactors. If implemented, the main objective of this technology will be to oxidize the contaminants of interest. Bioslurry reactors may provide rapid biodegradation of contaminants due to enhanced mass transfer rates and increased contaminant to microorganism contact[1].

Increased concentration of active biomass, improved oxygen delivery, and optimized environment in bioslurry reactors, may allow for treatment of high concentrations of organic contaminants in soils and sludges. Biodegradation of soils and sludges with selected contaminant concentrations ranging from 2,500 to 250,000 mg/kg in bioslurry reactors has been demonstrated[1].

Contaminant reduction in bioslurry reactors is improved through proper feed preparation. Preparation of the influent waste stream should produce the general characteristics presented in Table 1-2.

1.3.1 Treatment Process and Scale

Full-scale commercial bioslurry units are estimated to require approximately 0.5 to 1 acre per million gallons of reactor volume[1]. Reactor size is determined based on the hydraulic and biological solids retention times required for treatment. Retention times are established based on the biodegradability of the waste, level of treatment required, influent contaminant concentration, and physical/chemical nature of the waste. Treatability studies are often required to estimate full-scale reactor size.

During the Phase I treatability study, approximately 750 pounds of soil was wet sieved and prepared for laboratory-scale batch and bioslurry reactor testing. Process scale for laboratory testing was approximately 60 liter (l). Influent slurry (approximately 30 percent) was introduced to the reactor to achieve a 30-day hydraulic retention time (HRT). The system employed solids recycle and maintained a biological solids retention time (BSRT) set point of 38 days.

Table 1-1
Physical/Chemical Properties of CPAH Constituents

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Carcinogenic Polynuclear Aromatic Hydrocarbons	K_{ow} (log)	Aqueous Solubility (µg/l)	V.P at 20°C (torr)
benz(a)anthracene	5.61	14	5.0×10^{-9}
benzo(a)pyrene	6.04	3.8	5.0×10^{-7}
benzo(b)fluoranthene	6.57	1.2	5.0×10^{-7}
benzo(k)fluoranthene	6.84	0.55	5.0×10^{-7}
chrysene	5.61	2	6.3×10^{-7}
dibenz(a,h)anthracene	5.97	.50	1.0×10^{-10}
benzo(g,h,i)perylene	7.23	0.26	1.0×10^{-10}
indeno(1,2,3-c,d)pyrene	7.66	62	1.0×10^{-10}

Sims, R. C. and M. R. Overcash "Fate of Polynuclear Aromatic Compounds (PNAs) in Soil - Plant Systems," *Residue Reviews*, 1983.

µg/l - micrograms per liter
V.P. - vapor pressure

Table 1-2
General Influent Feed Characteristics for Bioslurry Treatment

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Parameter	Target
Organics	0.025 - 25 percent by weight
Solids	10 - 40 percent by weight
Water	60 - 90 percent by weight
Solids Particle Size	Less than 1/4 inch
Temperature	15 - 35°C
pH	4.5 - 8.8

EPA, 1990, "Slurry Biodegradation," EPA/540/290/016.

1.3.2 Operating Features

Bioslurry reactor systems aerobically biodegrade aqueous slurries created through the mixing of soils or sludges with water. The most common mode of bioslurry treatment is batch; however, continuous-flow operation can be achieved. Aeration is provided through floating or submerged aerators or compressors and spargers. Mixing may be achieved through aeration alone or in conjunction with mechanical mixers. Nutrient addition and pH adjustment are accomplished through metered chemical addition to the reactor vessel. Following aeration, the treated slurry is dewatered via standard dewatering equipment, such as clarifiers or filtration[1].

The residual streams created during bioslurry remediation include treated solids, process water, and possible air emissions. The process water collected during the solids/liquid separation phase is usually recycled for influent waste stream slurrying or discharged under permit. Air emissions may be minimized through system design and air pollution control devices.

1.3.3 Biodegradation of PAH

Bioslurry treatment of PAH relies on the effective biological attack of the compounds by indigenous microbial populations. Environmental biotransformation and mineralization of several PAHs by indigenous populations in soils has been documented[2,3,4] and an extensive database has been developed and reviewed on the biochemistry of PAH degradation by aerobic microorganisms[5 - 11]. Mineralization or oxidation of phenanthrene and anthracene has been reported[12 - 23]. Acenaphthene, acenaphthylene, fluorene, and fluoranthene have been reported to be oxidized or used as sole carbon sources[13,24,25,26]. A *Mycobacterium* sp. has been isolated, which was capable of extensive degradation of pyrene[27,28,29]. Benzo(a)pyrene (B[a]P) and benz(a)anthracene have been shown to be oxidized to dihydrodiols by a mutant strain of *Beijerinckia* sp.[30]. More recently, *Beijerinckia* strain B1 was shown to oxidize benz(a)anthracene after induction with biphenyl, m-xylene, and salicylate[31]. Intermediates identified were 1-hydroxy-2-anthranoic acid, 2-hydroxy phenanthranoic acid, and 3-hydroxy phenanthranoic acid. Methyl-hydroxylated metabolites of 7,12-dimethyl-benz(a)anthracene were reportedly produced by cultures of *P. aeruginosa*[32].

The use of bioslurry reactors for PAH degradation has been described by Mueller et al., (1991)[33] and Lewis (1992)[34]. Mueller et al., (1991) treated a creosote-contaminated soil that

was washed with 0.05 percent Triton X-100. The resulting slurry and soil fines (<2 millimeter [mm]) were used to charge the bioreactor. Mueller reported that greater than 50 percent of the targeted PAH was degraded after 3 to 5 days. However, after approximately 10 days, no further biodegradation in the higher molecular weight PAH occurred. No rates of degradation were reported. No attempts to optimize the PAH-degrading bacterial population were made.

Lewis (1992) reported the use of Eimco Biolift™ reactors operated in batch mode to treat a PAH-contaminated soil over a 12-week period. All the reactors were bioaugmented with PAH-degrading bacteria previously isolated from the same soil. Inorganic nutrients were added to each reactor. After 9 weeks, four reactors were reseeded with the PAH-degrading culture and two of these reactors were amended with Tween 80, a commercially-available surfactant. After 2 weeks of operation, 95.9 $\pm$ 1.8 percent of the 2- and 3-ring PAH was degraded and 81.6 $\pm$ 3.9 percent of the 4-ring and higher PAH was degraded. Total PAH and CPAH degradation after 12 weeks of operation averaged 93.4 $\pm$ 3.2 and 89.1 $\pm$ 4.3 percent, respectively, for all five reactors.

Lewis (1992) acknowledged that the majority of degradation occurred within the first 2 to 3 weeks of operation and that semicontinuous mode is the preferred mode of operation as compared to prolonged batch operation. A CPAH removal of 81.6 percent was measured during the first 2 weeks of operation; CPAH concentrations decreased only by an additional 7.5 percent during the remaining 10-week period. Based on this observation, the author suggests that semicontinuous mode is preferable to prolonged batch treatment. Substrate removal kinetics and the bacterial population sizes of specific PAH-degrading microorganisms were not reported.

2.0 Conclusions and Recommendations

2.1 Conclusions

The bioslurry reactor, operating in continuous-flow and batch mode was unable to achieve the total carcinogenic polycyclic aromatic hydrocarbons (CPAH) target level of 6.1 milligrams per kilogram (mg/kg) . Overall, optimal reactor performance resulted in final CPAH concentrations of 180 mg/kg. This concentration is approximately equivalent to the final soil CPAH concentrations achieved during the initial batch (170 mg/kg) and the final batch bottle studies (150 mg/kg).

Because of the observed decrease in oxygen uptake rates and specific degrader population densities during operation of the reactor system, it was postulated that either an inhibitory substance was accumulating in the bioslurry or soil-bound CPAH were not available for biological attack. Additional testing of the slurry for potential inhibitors (i.e., halogenated volatile organic compounds, metals, and sulfides) did not reveal the presence of inhibitory substances.

The similarity in final CPAH concentrations throughout all studies suggest that the CPAH constituents may not have been bioavailable or were present in concentrations below the level required to induce the microbial biodegradation pathway.

2.2 Recommendations

Several recommendations to enhance the rate and extent of CPAH removal in the bioslurry reactor are discussed in the following text.

- The similarity in final CPAH concentrations throughout all studies does suggest that CPAH species were not bioavailable and/or the necessary degradative microbial populations were not active in the treated slurries. In addition, the lack of CPAH concentrations measured in the aqueous phase also suggests decreased bioavailability.

- Results from this and other studies suggest that the concentration of available CPAH was not sufficient to induce the enzymatic pathway required for biodegradation[35]. Analytical results indicate that naphthalene was not present above the analytical detection limit in the aqueous and solids phase. It has been shown that the naphthalene-degrading pathway can degrade phenanthrene

and anthracene[35] and possibly pyrene and benzo(a)pyrene (unpublished data). However, for the naphthalene-degrading pathway to be active, inducers must be present.

3.0 Treatability Study Approach

3.1 Test Objectives and Rationale

The Phase I treatability studies for biological slurry treatment included a batch slurry study and a bioslurry reactor study. The batch slurry study produced supporting data for optimizing the operation of the laboratory-scale bioslurry reactor. Batch slurry testing was conducted in sealed, 1-liter (l) vessels at solids loadings of 30 and 40 percent. The duration of the batch study was 6 weeks with sample analysis during initiation, Week 3, and Week 6. The objectives of this study included:

- Providing support data for optimizing operation of the bioslurry reactor
- Determining the impact of solids loading on operation
- Calculating preliminary substrate utilization rates.

Following the collection of the batch slurry study Week-3 data, the bioslurry reactor study was initiated. During the 3-month bioslurry study, a 60-l, stainless steel, Eimco Biolift™ slurry reactor was operated initially in continuous-flow and, subsequently, in batch mode. Operation of this unit under the optimum solids loading determined during batch testing provided performance data to determine the efficacy of meeting the specified treatment standard of 6.1 milligrams per kilogram (mg/kg) total carcinogenic polycyclic aromatic hydrocarbons (CPAH). The objectives of the bioslurry investigation included:

- Estimation of hydraulic retention time (HRT) and biological solids retention time (BSRT) set points for operation
- Determination of the efficacy of meeting the specified treatment standard
- Identification of requirements for additional physical/chemical pretreatment
- Generation of performance data upon which pilot-scale design can be established.

The dewatering of treated solids was not evaluated during this phase of the investigation.

3.2 Experimental Design and Procedures

The test material employed in the batch and bioslurry reactor studies was collected by Roy F. Weston, Inc. (Weston) from the Moss-American site. One composite soil sample was prepared to represent the anticipated average concentration of site contaminants.

3.2.1 Sample Procurement

Two shipments of site soil were delivered on October 28, 1992 and January 14, 1993 to IT

Corporation's (IT) Biotechnology Applications Center (BAC) via a certified, commercial carrier. The second soil shipment was required following initial evaluation of the soil pretreatment process. The prescreening process only generated 42 pounds (lb) of soil (dry weight) per 150 lb of soil sieved. Therefore, the total soil mass required for testing increased to approximately 750 lb from the previously estimated 150 lb. Appropriate shipping documentation (presented in Appendix B) accompanied all samples sent to the BAC.

Following the receipt of the soil, the containers were visually inspected and sample volumes recorded. All samples received at the BAC were automatically logged into a sample tracking system and given independent sample identification numbers. The sample identification number for the October 28, 1992 shipment of one 20-gallon drum was 09351192. The second shipment of four 20-gallon drums of soil on January 14, 1993 received sample identification numbers W01, W02, W03, and W04.

3.2.2 Soil Pretreatment

Soils from Sample Identification No. 09351192 were submitted to Eimco Process Equipment Company (Eimco) for initial testing to determine the appropriate slurry density and particle size required for bioslurry treatment. The Eimco final report is provided in Appendix C. Results of the Eimco study indicated that less than 28 mesh (0.589) particle size would allow effective treatment. Eimco also determined that a 35 percent slurry density was the maximum allowable for proper operation of the 60-l bioslurry reactor.

Prior to treatability testing, the subject soils (i.e., Sample Identification No. 09351192, W01, W02, W03, and W04) were wet sieved to achieve uniform particle-size distribution, per Eimco's recommendation. The same soil pretreatment techniques were employed for all soils tested during both batch and bioslurry investigations. The system employed a 2-foot (ft) by 1-ft by 4-ft galvanized aluminum tank with a 18-inch (in) by 26-in No. 30 mesh sieve placed on the rim. The sieve was a U.S.A. Standard Testing Sieve, American Society for Testing and Materials (ASTM) E-11 Specification, No. 30 mesh manufactured by Gilson Company, Inc. (Worthington, Ohio).

For each soil batch prepared, the tank was partially filled with distilled water. Two Little Giant 2E Series submersible pumps (aluminum housing, epoxy coating, nylon pump head and impeller, and polypropylene screen) were placed on bricks inside the tank. These pumps

were used to recirculate the wash water and, thereby, increase the slurry density of the mixture. Evaporation of excess wash water allowed for the development of a 30 percent or greater slurry density for treatability testing. Evaporation was achieved through air drying of the slurry mixture over a 24-hour period at room temperature.

All slurries prepared for testing were stored at room temperature until used.

3.2.3 Batch Slurry Testing

The batch slurry study was maintained for 6 weeks. The objective of this study was to determine the impact of solids loading on operation, provide supporting data for bioslurry reactor operation, and establish preliminary substrate and oxygen utilization rates.

Six treatments were evaluated including:

- Treatment 1 30 percent solids, nutrient and oxygen amended
- Treatment 2 30 percent solids, nutrient and oxygen amended
- Treatment 3 40 percent solids, nutrient and oxygen amended
- Treatment 4 40 percent solids, nutrient and oxygen amended
- Treatment 5 30 percent solids, biologically-inhibited control
- Treatment 6 40 percent solids, biologically-inhibited control.

Treatments 5 and 6 served as the biologically-inhibited controls for the study. Analysis of these treatments was to be used to determine abiotic losses of target compounds from the biologically-active treatments. However, as discussed in Section 4.1.2.1, biological activity was not inhibited at mercuric chloride concentrations as high as 1,500 milligrams per liter (mg/l). Treatments 2 and 4 were duplicates of 1 and 3, respectively. All treatments were placed in amber bottles to minimize light exposure.

The batch study was conducted in sterile, amber-glass, sealed, 1-l bottles. Soils were placed in the bottles at solids densities of approximately 30 and 40 weight percent. The total solids (TS) density of the prescreened slurry was determined to be 30 percent and used to establish Treatments 1, 2, and 5. A subsample of the 30 percent slurry was air dried at room temperature to a solids content of 44 percent and diluted with deionized water to a solids content of 40 percent. This material was used to establish Treatments 3, 4, and 6. An additional 400 milliliters (ml) of 30 and 40 percent slurries were generated for initial

analysis. The density of each slurry was determined and used to calculate the mass required to fill each bottle with 900 ml of slurry.

The treatment containers were continuously mixed and the slurry remained in suspension during the collection of Week 3 and Week 6 samples. Table 3-1 illustrates the change in headspace volume resulting from intermittent sampling.

Initial determination of the slurry pH and macronutrient concentrations, i.e., ammoniacal nitrogen and ortho-phosphate, was completed once treatment slurries had been prepared. As described in the Test Plan, a 100:10:1 carbon:nitrogen:phosphorus (C:N:P) ratio was the target for the study. Background ortho-phosphate concentrations within the treatment slurries were sufficient and did not require modification. The low ammoniacal nitrogen concentration required amendment to 500 mg/l ammoniacal nitrogen. This requirement was met by adding 6.8 grams (g) of a 74,000 mg/l solution of ammonium chloride directly to the 30 percent treatments. The 40 percent treatments received 8.1 g of the 74,000 mg/l ammonium chloride solution. Week 3 analysis indicated that further ammonium chloride addition was not required. Slurry pH was neutral at Week 0 and was adjusted from 6.5 to 7.0 following Week 3 using sodium hydroxide.

Treatments were sparged daily with oxygen to maintain an aerobic environment. Headspace oxygen measurements were made five times per week during the first 3 weeks of operation and weekly thereafter using a modified, galvanic-cell, oxygen probe[36]. Oxygen uptake rates were determined through analysis of oxygen depletion in the headspace over a 24-hour period.

Following preparation, the treatments were placed on a modified rotator, rotated at 6 revolutions per minute (rpm), and maintained at room temperature (19°C) throughout the course of the study. The modified rotator was constructed from a drill press. The drill press-driven rotisserie, holding six 1-l bottles, was chosen over conventional sparging and agitation systems due to improved suspension of the treatment solids. Following study completion, all treatment vessels were rinsed and solvent extracted, using dichloromethane, to determine adsorptive losses of contaminants.

Table 3-1
Change in Headspace Volume

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Sample Point	Volume (ml)	
	Initial thru Week 3	Week 3 thru Week 6
Slurry	900	500
Headspace	100	500

Preliminary specific substrate utilization rates (q) in the batch study, based on PAH and CPAH utilization per unit biomass were determined using the following equation:

$$q = \frac{(S_i - S_f)/\Delta t}{X} \qquad \text{(Equation 1)}$$

Where:

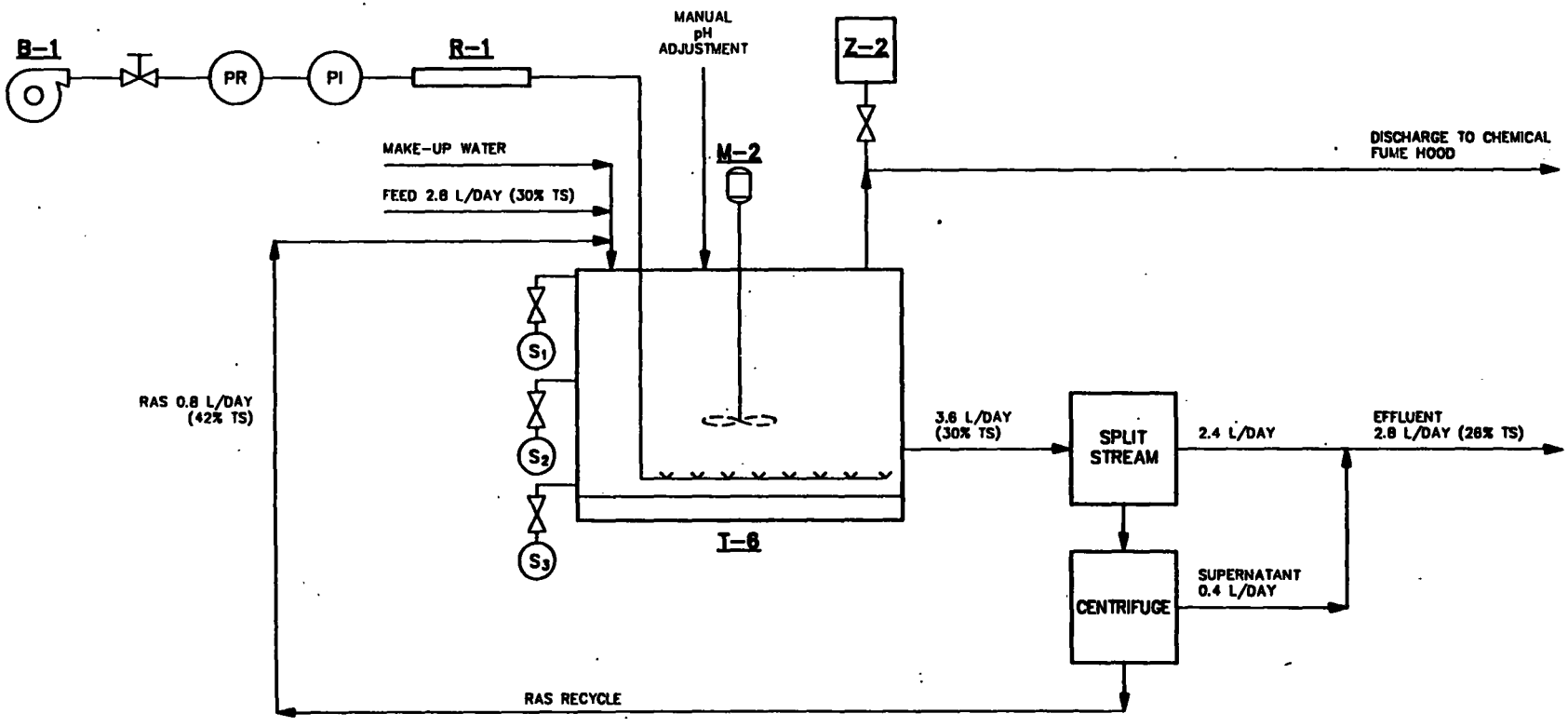
- q = specific substrate utilization rate (hr^{-1})
- S_i = Initial substrate concentration (mg)
- S_f = Final substrate concentration (mg)
- Δt = Time elapsed (hours)
- X = TS concentration in slurry (mg).

3.2.4 Bioslurry Reactor Study

Due to the similarity of activated sludge and bioslurry reactor systems, conventional acronyms such as waste activated sludge (WAS) and return activated sludge (RAS) are used to describe the slurry recycle system in the laboratory-scale bioslurry reactor.

A 60-l, stainless steel, Eimco Biolift slurry reactor was employed during this 3-month study and operated in both continuous-flow and batch mode. The process flow diagram (PFD) for the reactor system is presented in Figure 3-1. A 30 percent solids feed stream was introduced to the reaction vessel (Bioreactor T-6) at an average 5-day flow rate of 2.8 liters per day (l/day) resulting in a mathematical 7-day average flow of 2 l/day. At this daily influent flow rate, the bioslurry reactor HRT was maintained at 30 days. Reactor volume was monitored daily by measuring the reactor slurry column when mixing systems were stopped. Distilled water was added to compensate for any losses due to evaporation.

The system's BSRT was maintained through removal of 3.6 l/day of reactor slurry 5 days per week (Figure 3-1). The 3.6 l/day slurry could not be separated by settling; therefore, it was centrifuged. This stream was centrifuged to concentrate solids in the RAS stream. The 5-day average RAS flow rate was 0.8 l/day of approximately 42 percent solids. Following centrifugation, the supernatant was combined with the remainder of the extracted reactor slurry and analyzed as the effluent stream. BSRT was calculated based on the mass balance of solids in the reactor system. The system BSRT set point was approximately 38 days during continuous-flow operation. The operating set point was maintained for a period of 68 days prior to batch operation. Volumes removed for sample analysis were considered when calculating the WAS volume.



LEGEND:

PI — PRESSURE INDICATOR

PR — PRESSURE REGULATOR

S_1 — SAMPLE PORTS

B-1	R-1	M-2	I-6	Z-2
AIR COMPRESSOR	AIR ROTAMETER	BIOREACTOR MIXER	BIO REACTOR (60L)	AIR SAMPLING DEVICE

FIGURE 3-1
PROCESS FLOW DIAGRAM
LABORATORY - SCALE
BIOSLURRY REACTOR

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 03/03/92 | DATE LAST REV.: 7/8/93 | DRAFT. CHCK. BY: J. HUSBARD | INITIATOR: K. BROWN | DWG. NO.: 408491-B-01
DRAWN BY: S. CARDWELL | DRAWN BY: J. HUSBARD | ENGR. CHCK. BY: K. BROWN | PROJ. MGR.: K. BROWN | PROJ. NO.: 408491

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The Test Plan specified that the BSRT (day) of the laboratory-scale system would be approximated through mass balance of the system solids using the following equation:

$$BSRT = \frac{XV}{Q_w X_r + (Q-Q_w) X_e} \qquad \text{(Equation 2)}$$

Where:

X = TS concentration in the aeration vessel (mg/l)
V = Volume of the aeration vessel (l)
Q_w = WAS flow rate (l/day)
X_r = TS concentration in RAS (mg/l)
Q = Influent flow rate (l/day)
X_e = TS concentration in system effluent (mg/l).

Due to the problems associated with solids separation, the equation was modified and reflected the mass balance of system solids:

$$BSRT = \frac{XV}{V_e X_e} \qquad \text{(Equation 3)}$$

Where:

X = TS concentration in the aeration vessel (mg/l)
V = Volume of reactor slurry (l)
V_e = Volume of effluent sample (l)
X_e = TS concentration in system effluent (mg/l).

Reactor operating conditions were maintained at approximately 22°C, 6.2 mg/l dissolved oxygen, and pH 6.3. Dissolved oxygen was supplied to the unit via the sparging of ambient air from a commercial, oil-free compressor. Influent air flow rates could not be adjusted to substantially reduce bioslurry dissolved oxygen concentrations because air flow from the compressor could not be regulated. System pH was initially maintained through manual additions of 5 Normal (N) sodium hydroxide to the reaction vessel. Although pH adjustment was made more than twice per day on occasion, the pH continued to shift toward acidity even during periods of reduced biological activity. The pH was allowed to equilibrate at an average of 6.3, as no effect on the biological activity of the system was noted during reduced pH episodes.

All operational set points are listed below:

Parameter	Set Point	Test Plan Objective
Feed flow	2 l/day (7-day average)	2 l/day
HRT	30 days	30 days
Temperature	22°C	Room Temperature
Dissolved Oxygen	6.2 mg/l	3 mg/l
pH	6.3	7 - 8
BSRT	38 days	$\geq$ 30 days
Reactor Volume	60 l	60 l
Return Activated Sludge	0.57 l/day (7-day average)	0.2 l/day

Following continuous-flow operation, the bioslurry reactor was operated in batch mode for a period of approximately 5 weeks. Once RAS and influent feed addition was suspended for batch treatment, all other operational set points were maintained the same as during continuous-flow operation. Volume was corrected for evaporation losses daily.

Volatilization of influent constituents was quantified in the reactor system. Volatilization that occurred during reactor aeration and mixing was vented to a chemical fume hood. Bioslurry reactor headspace sampling for volatiles and semivolatiles was conducted weekly. These samples were analyzed to assist in the calculation of the system's material balance, however the majority of volatile constituents present were probably lost during soil pretreatment.

Following batch operation, the bioslurry reactor was drained, washed with distilled water, and solvent extracted, using dichloromethane. Polycyclic aromatic hydrocarbons (PAH), CPAH, TS, volatile solids (VS), volume, and slurry density were measured on all waste streams generated during reactor cleanup. The total mass of contaminant removed was calculated.

3.2.5 Final Batch Bottle Study

Because of the reduction in PAH removal experienced during continuous-flow operation of the bioslurry reactor, an additional batch bottle study was initiated. The study was

established identically to the initial bottle study and maintained for a period of 6 weeks. Bioslurry reactor influent feed was employed in the study. Following the completion of the final bottle study, the treatment vessel was extracted and analyzed to account for any losses due to adsorption.

3.3 Equipment and Materials

The batch bottle and final bottle studies were conducted in sterile, glass, sealed, 1-l bottles. The sample collection port on the containers consisted of a Teflon™ half-hole septum in the Teflon™ cap of the bottle. Headspace gas samples were collected through the septum using a Supelco Pressure-Lok Series A-2 syringe. Sample bottles were opened at 3 and 6 week sampling events to permit slurry collection.

The laboratory-scale bioslurry investigation was conducted in a continuous-flow, completely mixed, 60-l, stainless steel, Eimco Biolift slurry reactor. The system PFD is shown in Figure 3-1. Materials of construction were primarily stainless steel and Viton™ tubing. During air sampling, the reactor headspace was in contact with Teflon probes and stainless steel tubing.

The bioreactor (T-6) was equipped with controllers to maintain agitation and air flow rate. Agitation was maintained using a mixing impeller (M-2), sparged air, and an airlift system to improve the system oxygen transfer efficiency. Hydrocarbon-free, ambient air from a commercial, oil-free compressor was used to supply air to the bioreactor through a sparger installed at the bottom of the reactor. Following 11 weeks of operation, the original compressor received from Eimco failed. The failed compressor was immediately changed and no significant loss of dissolved oxygen concentration was reported. During the 13th week of operation, the new compressor failed and was once again changed. Both compressor failures were attributed to blockage of the influent air flow line which could not be fixed during system operation. No adverse effects to operation were noted. The mixed liquor pH was maintained in the optimal range for biodegradation by the manual addition of sodium hydroxide.

Volatilization from the aerated slurry was vented to a chemical fume hood before discharge to the atmosphere. Headspace semivolatile and volatile constituents were measured through weekly air sampling at Z-2 (Figure 3-1). The semivolatile air sampling train consisted of

stainless steel tubing connected to an XAD-2 sorbent sampling tube. The air sampling system used to collect volatile off-gas samples consisted of a stainless steel Summa™ polished canister, Milaflow pneumatic flow controller set at 10 cubic centimeters per minute (cm^3/min), and stainless steel tubing.

Other major pieces of equipment utilized during this project are listed below:

- Gas chromatograph, Hewlett Packard 5890A
- High performance liquid chromatograph (HPLC), Dionex Liquid Chromatograph Model DX-300 and Dionex A1-450 Chromatograph computer software
- Total Organic Compounds (TOC) Analyzer, Dohrmann DC-80
- Oxygen detection device, IT patent pending
- Eimco Biolift Slurry Reactor
- Various incubators, shakers, pH electrodes, ion-selective electrodes, spectrophotometers
- IEC Centra-4B Centrifuge (International Equipment Company)
- YSI Dissolved Oxygen Meter, Model 50 and YSI Dissolved Oxygen Probe Model 5739
- Personal computers.

3.4 Sampling and Analysis

3.4.1 Initial Waste Characterization

Initial site material used for the batch bottle study was received on October 28, 1992. The shipment consisted of one 20-gallon drum of site soil. The second shipment of four 20-gallon drums of soil were received on January 14, 1993. In accordance with the project-specific Test Plan, soils were prescreened and analyzed for aqueous and solids phase PAH; TS/VS; microbial enumerations; nutrient concentrations; pH; benzene, toluene, xylenes (BTX); and total organic carbon (TOC)/total carbon (TC). TOC measurements were made to determine organic carbon concentrations in the aqueous phase. TC determinations to quantify the carbon concentration in solids samples differ from TOC measurements by including both organic and inorganic carbon concentrations.

3.4.2 Treatment Process

3.4.2.1 Batch Slurry Study

Approximately 400 ml of slurry was collected during each of the three sampling periods.

The analytical parameters monitored at study initiation, Week 3, and Week 6 in the aqueous phase of each treatment were PAH, BTX, pH, and TOC. The slurry phase was monitored for TS and VS concentrations, pH, microbial density of heterotrophic bacteria and anthracene degraders, and macronutrient concentrations. Due to difficulties in determining specific degrader populations, mineralization of radio-labeled anthracene was determined at Week 3 and Week 6. The soil fraction of each treatment was monitored for PAH, BTX, and TC concentrations. Following study completion, all treatment vessels were rinsed and solvent extracted, using dichloromethane, to determine adsorptive losses of contaminants.

The sampling schedule for the batch bottle study is presented in Table 3-2. The sampling schedule defined in the approved Test Plan was maintained throughout the batch study. In addition to the specifications of the Test Plan, anthracene mineralization experiments and TC analyses of the solids were conducted.

3.4.2.2 Bioslurry Reactor Study

The operating conditions for temperature, dissolved oxygen, and pH were monitored 5 times per week. For clarification of the following text, sample identifiers are labeled in Figure 3-1. All mixed liquor reactor samples were collected from the second sampling port located on the side of the bioslurry reactor (S2).

The sampling schedule for the bioslurry reactor study is presented in Table 3-3. In addition to the requirements of the Test Plan, several analyses including anthracene mineralization testing, oxygen uptake rates, slurry density analysis, VOC, metals, and sulfide determinations were conducted to facilitate the evaluation of system performance.

The influent waste stream was characterized for PAH concentrations in the aqueous and solids phase twice per week. The influent slurry was also analyzed for TS and VS concentrations twice per week.

The reactor slurry was collected from Sample Port S2. The reactor slurry particle size was monitored once a week to determine its impact on the release of soil-bound contaminants. The reactor slurry phase was also monitored twice weekly for TS and VS concentrations. Microbial enumerations of total heterotrophs and anthracene degraders were conducted once per week. Gene probe analysis for naphthalene degraders was initiated on February 15,

Table 3-2
Batch Slurry Study Sampling and Analysis Schedule

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Treatment No. 1-6	Analysis								Volume Removed	Frequency
	PAH	BTX	TOC	N&P	pH	TS	VS	Micro		
Aqueous	100 ml	50 ml	10 ml		--				370 ml	3/Treatment
Slurry				20 ml		20 ml	--	10 ml	30 ml	3/Treatment
Solids*	20 g	10 g								3/Treatment
Total									400 ml	

PAH - Polycyclic aromatic hydrocarbons
BTX - Benzene-toluene-xylene
TOC - Total organic carbon
N&P - Ammoniacal nitrogen and ortho-phosphate
DO - Dissolved oxygen
TS - Total solids
ml - milliliter
g - grams
VS - Volatile solids
Micro - Microbial enumerations

* - Solids samples were generated through centrifugation of slurry samples.

Table 3-3
Bioslurry Reactor Study Sampling and Analysis Schedule

IT Project No. 408491

(Page 1 of 2)

Sample Point	Analysis									
	PAH	BTX	TOC/TC	N&P	DO	pH	TS	VS	Micro	Particle Size
Influent Waste Stream (S_1)										
Aqueous (S_1)										
Volume	100 ml	--	--	--	--	--	--	--	--	--
Frequency	2/wk	--	--	--	--	--	--	--	--	--
Slurry (S_1)										
Volume	--	--	--	--	--	--	20 ml	--	--	--
Frequency	--	--	--	--	--	--	2/wk	2/wk	--	--
Solids (S_1)										
Volume	20 g	--	--	--	--	--	--	--	--	--
Frequency	2/wk	--	--	--	--	--	--	--	--	--
Reactor Mixed Liquor (S_2)										
Aqueous (S_2)										
Volume	100 ml	50 ml	10 ml	20 ml	--	--	--	--	--	--
Frequency	2/wk	1/wk	2/wk	1/wk	--	--	--	--	--	--
Slurry (S_2)										
Volume	--	--	--	--	1 ml	--	20 ml	--	10 ml	500 ml
Frequency	--	--	--	--	2/wk	2/wk	2/wk	2/wk	1/wk	1/wk

Table 3-3
Bioslurry Reactor Study Sampling and Analysis Schedule

IT Project No. 408491

Page (2 of 2)

Sample Point	Analysis									
	PAH	BTX	TOC/TC	N&P	DO	pH	TS	VS	Micro	Particle Size
Solids (S_3)										
Volume	20 g	10 g	--	--	--	--	--	--	--	--
Frequency	2/wk	1/wk	2/wk	--	--	--	--	--	--	--
RAS (S_3)										
Aqueous (S_3)										
Volume	100 ml	--	--	--	--	--	--	--	--	--
Frequency	1/wk	--	--	--	--	--	--	--	--	--
Slurry (S_3)										
Volume	--	--	--	--	--	--	20 ml	--	--	--
Frequency	--	--	--	--	--	--	2/wk	2/wk	--	--
Solids (S_3)										
Volume	20 g	--	--	--	--	--	--	--	--	--
Frequency	1/wk	--	--	--	--	--	--	--	--	--
Effluent Waste Stream (S_4)										
Slurry (S_4)										
Volume	--	--	--	--	--	--	20 ml	--	--	--
Frequency	--	--	--	--	--	--	2/wk	2/wk	--	--
Air (Z_2)	1/wk	1/wk	--	--	--	--	--	--	--	--

PAH - Polynuclear aromatic hydrocarbons
BTX - Benzene, toluene, xylene
TOC - Total organic carbon
N&P - Ammoniacal nitrogen and ortho-phosphate
DO - Dissolved oxygen
TS - Total solids
ml - milliliter
g - grams
VS - Volatile solids
Micro - Microbial enumerations
RAS - Return Activated Sludge
wk - Week
t_0 - Initial characterization
S_1 - Influent sample port
S_2 - Mixed liquor sample port
S_3 - RAS sample port
S_4 - Effluent sample port
TC - Total carbon

1993, following 3 weeks of operation. The analysis was conducted on slurry grab samples collected from Sample Port S2. To compare bioslurry reactor operation with the initial batch bottle study, anthracene mineralization testing was also conducted.

The reactor slurry-phase macronutrient concentrations were monitored once per week. The macronutrient concentrations were controlled to maintain a residual concentration of 100 mg/kg ammoniacal nitrogen in slurry phase. Ammonium chloride was directly added in batch to the reaction vessel; phosphate addition was not required.

Aqueous- and solid-phase PAH, TC, and TOC concentrations in the reaction vessel were monitored twice weekly (S2). The volatile organic compound (VOC) concentration of the aqueous and solids phase was determined once per week, beginning April 2, 1993. The PAH content of the aqueous and solids phase was measured in the RAS stream once per week.

To accurately determine the system BSRT, TS, and VS concentrations of the RAS and effluent were determined twice weekly in the slurry phase. Because of expected variability in the VS measurement, TS concentrations were used to calculate the BSRT value.

Volatilization of contaminants was monitored to complete the mass balance of carbon in the system. Air monitoring for volatiles and semivolatiles was conducted weekly. Headspace constituents were determined through the analysis of air sampled through Z-2 (Figure 3-1).

Complete mixing of the reactor solids was verified once prior to system start-up and twice during continuous-flow operation. Verification was accomplished through the analysis of sample TS concentrations collected from the three sample ports located on the side of the bioslurry reactor (Table 3-4). The three ports represented three potentially distinct zones of the slurry. The bottom sample port provided sample material from within the rake-mixing zone. The middle port provided sample material from within the well-mixed zone. Finally, the top sample port provided sample material of slurry or any oil phase that might have been present. As shown in Table 3-4, analysis of the samples for TS concentration illustrated uniform mixing throughout the reactor during the study period.

Table 3-4
Uniform Mixing
Bioslurry Reactor Study

IT Project No. 408491

Sample Point	TS (%)		VS (%)	
	2/4/93	3/11/93	2/4/93	3/11/93
S-1	33	31	8.7	9.5
S-2	30	34	8.2	9.5
S-3	30	32	8.4	9.0

During batch operation of the bioslurry reactor VOC analysis of the reactor slurry was initiated. Analysis of the influent, RAS, and effluent waste streams was halted. In addition, three samples collected from the reactor effluent during continuous-flow operation, reactor slurry, and final bottle study were analyzed for metals content, including arsenic, barium, cadmium, chromium, lead, and sulfide.

3.4.2.3 Final Batch Study

Due to the reduced PAH degradation observed in the bioslurry reactor, an addition bottle study employing the second delivery of influent feed and reactor slurry was undertaken. This study was completed to compliment the requirements of the Test Plan.

Slurry samples were collected at initiation and Week 6 and analyzed for PAH, CPAH, and metals concentrations. In addition, the headspace oxygen concentration and oxygen uptake rate were also monitored. Gene probe analysis was used to determine naphthalene degrading microbial population densities.

3.4.3 Analytical Methods

All treatability testing was completed in the BAC laboratory located in Knoxville, Tennessee. This facility holds a special exemption from the State of Tennessee that permits execution of treatability studies. The BAC laboratory operates in accordance with an approved Chemical Hygiene Plan (CHP). All activities at the BAC conform to the standards set forth in the CHP.

Target compound analyses used modified Environmental Protection Agency (EPA)-approved methods. PAH concentrations were determined using modified EPA Method 8310. EPA Method 8310 refers to several extraction techniques including Method 3540 for Soxhlet extraction.

For PAH analysis, 10 g of soil sample was mixed with anhydrous sodium sulfate, placed in an extraction thimble and extracted using 200 ml of methylene chloride in a Soxhlet extractor for 24 hours. (The dry weight of the solid phase was analyzed by weight loss in a 105°C drying oven.) The extract was then concentrated to 1 ml using a Snyder column and solvent exchanged to 100 ml acetonitrile. Following extraction, the sample was analyzed using a Dionex Liquid Chromatograph equipped with a UV detector at 254 nm. Contaminants in

aqueous-phase were quantified by direct injection into the HPLC and analyzed by a florescence detector. Data were collected using Dionex A1-450 chromatographic computer software.

Nanograde methylene chloride and acetonitrile and analytical reagent-grade anhydrous sodium sulfate were used in the extraction method. Supleco PAH standard 610-M Lot No. LA3393 and Chem Service PAH PP-HC6 high concentration Lot No. 99-59A were used for instrument calibration and the preparation of spiking standards, respectively. The HPLC was calibrated using a three-point calibration curve.

Matrix spikes and blanks were analyzed during analysis of 26 percent of the solids samples collected for PAH analysis. Data generated during matrix spike and blank analyses are discussed in Chapter 4.0. These samples were analyzed to determine the method recovery efficiency.

Method blanks were generated by placing anhydrous sodium sulfate in an extraction thimble and extracting with methylene chloride in a Soxhlet extractor. The method blank samples were concentrated, solvent exchanged, and analyzed in the same manner as soil samples.

Matrix spikes were prepared by the addition of concentrated CPAH solutions to soil samples contained in the extraction thimble and Soxhlet extracted. Extractions and analysis were performed using the same method as used for sample analysis. Percent recoveries based on spike solution analyses were determined.

The BTX concentration was determined using modified EPA Method 8020. BTX samples were extracted via solvent extraction and sonication. Samples were analyzed using capillary GC/flame ionization detector (FID).

Intermittent samples were also analyzed for semivolatiles, VOC, halogenated VOC, and metals using EPA Methods 8270, 8240, 8010, 6010, respectively.

TS and VS measurements were made in accordance with Standard Method 2540G[37]. This method was applicable to determining TS and VS fractions in solid and semisolid samples.

Method 2540B was also used for TS and VS analyses to accommodate smaller sample volumes and achieve faster results.

Slurry-phase ammoniacal nitrogen was determined using an ion-selective electrode method [BAC Standard Operating Procedure (SOP) No. BAC022]. Analysis of ortho-phosphate was completed using the BAC SOP No. BAC015 derived from ascorbic acid Standard Method 4500-P E. All BAC SOPs are included in Appendix D.

TOC measurements in the aqueous phase were made using a Dohrmann DC-80 TOC Analyzer. The persulfate-UV oxidation Standard Method 5310-C was used for this determination. TC measurements of the solids phase was accomplished through pyrolyzation of solids, collection of off-gases in a Tedlar bag, and analysis of bag contents using colorimetric, chemical reactor tubes.

The total heterotrophic microbial enumeration analyses were performed using the BAC SOP No. BAC009 for plate count technique. To assess the activity of the PAH-degrading bacteria, activity against anthracene was determined by spraying selected plates with a 0.5 percent anthracene solution (acetone as the carrier). The carrier evaporates leaving a white anthracene film on the surface of the plate. As bacterial colonies metabolized the anthracene, clear zones were observed around the colonies. Anthracene was chosen because it is a general indicator of activity against PAH. The spray plate method is not useful for higher molecular weight PAH because the physical nature of the compounds precludes detection of clearing zones, and it is less likely that many bacteria can utilize them as sole carbon sources.

Gene probe analysis for the naphthalene pathway was conducted on agar plates. The naphthalene pathway was monitored because it has been shown that this model pathway can not only degrade naphthalene but phenanthrene and anthracene[35]. Mineralization of spiked ^{14}C anthracene was determined by measuring the quantity of ^{14}C-carbon dioxide evolved during the incubation of slurry samples. The anthracene experimental method is included in Appendix E.

The slurry-phase pH was determined using BAC SOP No. BAC014 derived from EPA Method 150.1 and *Methods of Soil Analysis* Part 2, Second Edition, pages 206 - 207. The

oxygen concentration in the headspace and slurry samples was determined using a modified, galvanic-cell, oxygen probe[36] and YSI oxygen meter, respectively. BAC SOP No. BAC021 was used during oxygen measurements. The slurry phase particle size distribution was determined using ASTM Method D422.

Air sampling was conducted following guidelines of EPA Method 18 and National Institute of Occupational Safety and Health (NIOSH) Method 5506 for measurement of PAH. Sample volume was measured using a rotameter. The sample was collected at a constant rate of 250 cm^3/min for 24 hours. Analyses were conducted by GC/MS in accordance with the procedures of Method 8270 of *Test Methods for Evaluating Solids Wastes, Physical/ Chemical Methods*, EPA SW 846.

An EPA Method TO-14 sampling system was used to measure the volatile organics in air. Canister samples were analyzed in a Finnigan Model OWA 1050 GC/MS system with a quadruple MS. This system was equipped with a Tekmar Model 5000 cryogenic concentrator and sample introduction system.

3.5 Data Management

Data collected during execution of the study was recorded in a bound, controlled laboratory notebook. Data generated from integrators and computerized instruments were printed with the resulting data sheets kept with the project file. Computer programs were documented in sufficient detail to satisfy requirements, needs, and intended use of the program. All data and computer programs were verified and checked by a BAC scientist.

3.6 Deviations from the Test Plan

3.6.1 Batch Slurry Study

Modifications to the Test Plan procedure for conducting the batch bottle study are listed in Table 3-5 and provided in Appendix F. These modifications were determined necessary to generate reliable data and successfully operate the batch study. All modifications were discussed and approved prior to implementation.

3.6.2 Bioslurry Reactor Study

The following text describes modifications made to the bioslurry reactor Test Plan. The soil

Table 3-5
Batch Study Modifications

IT Project No. 408491

ITEM	ORIGINAL TEST PLAN	PROPOSED MODIFICATION	RATIONALE
Maintenance of dissolved oxygen during batch testing	Hydrogen peroxide addition to slurry. Daily monitoring of slurry DO using IT oxygen probe.	Pure oxygen purging of headspace. Daily monitoring of DO in headspace. Headspace will be maintained saturated with O_2.	40% slurry density is too thick to be introduced into the oxygen probe and determine the concentration of H_2O_2 in slurry. Purging of the headspace with O_2 in combination with continued mixing, will maintain adequate dissolved oxygen in the slurry while maintaining the integrity of the treatments. The use of conventional membrane DO probes was considered, however, they are unreliable in slurries and would require opening the treatments daily.
Batch treatment sampling device	Teflon™ tubing inserted through a Teflon cap. Samples withdrawn using gas-tight syringe.	Teflon septum and Teflon screw cap. Sample withdrawn through pipetting.	Slurry density too thick to be withdrawn by original system.
Initial batch treatment volume	1,000 ml or zero headspace	900 ml	The reduced volume does not affect the analytical regime and allows for improved aeration in the event that DO is maintained using O_2 purging.
Batch treatment slurry densities	20 and 30% or Eimco recommendation (page 4-3 of Test Plan)	30 and 40%	Recommended by Eimco during initial testing.
Stir bars in batch treatments	Each treatment contained a stir bar	No stir bars. Manual mixing prior to sample collection.	During rotation it was feared that the stir bars would break the treatment vessels.
Modified tube rotator speed	200 rpm	6 rpm	Modified tube rotator cannot be safely operated at 200 rpm. 6 rpm provides more than adequate mixing, safely.

The third nonconformance reported concerned sample preservation. The composite sample of the 30 percent treatments at Week 6 sampling was sent to IT Analytical Services (ITAS) for sulfide and metals analysis and received at 9°C rather than 4°C. The sample was processed as received.

Standard BAC laboratory protocol for PAH and CPAH measurements in the solids-phase included the analysis of method blanks and matrix spikes. The Test Plan required the evaluation of 10 percent of PAH analyses as quality control samples. Approximately 26 percent of all soil samples analyzed were control samples. Surrogate addition analysis was not part of the BAC Standard laboratory protocol for PAH.

Using BAC standard laboratory protocol, a three-point curve was used to routinely calibrate the instrument. Following the completion of the bioslurry study, prior to analysis of the final batch study samples, a third-party laboratory check standard was obtained from ITAS and analyzed.

Following extraction, the solids samples were analyzed using a Dionex Liquid Chromatograph equipped with a UV detector at 254 nm. The aqueous-phase was directly injected into the HPLC and analyzed by a florescence detector. Further discussion of the BAC protocol for PAH analysis is provided in Section 4.2.2.

4.0 Results and Discussion

4.1 Data Analysis and Interpretation

4.1.1 Analysis of Waste Characteristics

Initial site material used for the batch bottle study was received on October 28, 1992. The shipment consisted of one 20-gallon drum of site soil. Following the prescreening process, the total polycyclic aromatic hydrocarbon (PAH) and carcinogenic PAH (CPAH) concentration in the soil averaged 1,300 and 460 milligrams per kilogram (mg/kg), respectively. The benzene, toluene, xylene (BTX) concentrations in this soil shipment following the pretreatment sieving were below the detection limit for the analysis.

The second shipment of four 20-gallon drums of soil was received on January 14, 1993. The first drum of these soils was prescreened on February 16, 1993 and used as influent feed for the bioslurry reactor system beginning on February 17, 1993. The remaining drums were prescreened on February 23 through 25, 1993. From February 17 through April 1, 1993, the influent average PAH and CPAH concentrations were 1,020 and 240 mg/kg, respectively. PAH concentrations ranged from 720 mg/kg to 1,200 mg/kg. The CPAH fraction ranged from 200 to 300 mg/kg. Analytical results indicate that the first and second soil shipments were generally similar in PAH and CPAH concentrations.

4.1.2 Analysis of Treatability Study Data

4.1.2.1 Batch Study

Six treatments were evaluated during the 6-week batch bottle study. These treatments included:

- Treatment 1 — 30 percent solids, nutrient and oxygen amended
- Treatment 2 — 30 percent solids, nutrient and oxygen amended
- Treatment 3 — 40 percent solids, nutrient and oxygen amended
- Treatment 4 — 40 percent solids, nutrient and oxygen amended
- Treatment 5 — 30 percent solids, biologically-inhibited control
- Treatment 6 — 40 percent solids, biologically-inhibited control.

Treatments were evaluated at study initiation, Week-3, and Week-6. Analytical results for the three sample points are presented in Tables 4-1 through 4-3. These Tables provide results from microbial enumeration, nutrient analysis, total solids (TS) and volatile solids (VS) determinations, pH and temperature measurements, BTX, total organic carbon (TOC) and total carbon (TC) concentrations.

Macronutrient concentrations, i.e., ammoniacal nitrogen and ortho-phosphate, were maintained in adequate concentrations for biological activity. The Test Plan specified the maintenance of a carbon:nitrogen:phosphorus ratio of 100:10:1. However, based on TC concentration in the solids, this would have required the addition of 4,900 mg/kg nitrogen and 490 mg/kg phosphate. This nitrogen concentration was considered excessive; therefore, nitrogen and phosphate concentrations were maintained at a residual concentration of at least 200 mg/kg. The initial slurry-phase ammoniacal nitrogen concentration was 460 mg/kg. During 6 weeks of operation, this concentration decreased to an average of 280 mg/kg nitrogen in all treatments. Initial slurry-phase phosphate concentrations averaged 640 mg/kg in all treatments. Phosphate concentrations decreased within 6 weeks to 200 mg/kg across all treatments.

Both aqueous- and slurry-phase pH measurements were made. Aqueous and slurry phase pH decreased to 6.6 and 5.7, respectively, during 3 weeks of operation. The pH was readjusted following Week 3 to 7. Continued aeration of the vessels for the remaining 3 weeks resulted in a slight decrease of aqueous- and slurry-phase pH to 6.6 and 6.2, respectively. The average room temperature maintained throughout the bottle study was 19°C.

Target TS concentrations for the batch bottle study were 30 and 40 percent. TS and VS concentrations in all treatments determined at initiation, Week 3 and Week 6 are presented in Tables 4-1 through 4-3. At initiation, the average TS and VS concentrations of Treatments 1, 2, and 5 were 31 and 9 percent, respectively. Treatments 3, 4, and 6 were established with average TS and VS concentrations of 39 and 10 percent, respectively. No significant reduction in TS/VS concentrations was noted during the 6-week study.

Total heterotrophic microbial populations in Treatments 1 through 4 averaged 10^8 colony forming units/gram (CFU/g) throughout the investigation. Biologically-inhibited Treatments 5 and 6 also demonstrated heterotrophic counts of 10^8 CFU/g despite continued addition of

Table 4-1
Batch Slurry Study Initial Analytical Results

IT Project No. 408491

Analytical Parameter	Treatments					
	1	2	3	4	5	6
Total Heterotrophs (CFU/g)	3.0×10^8	TNC	3.2×10^8	TNC	2.1×10^8	4.5×10^8
Specific Degraders (CFU/g)	S	S	S	S	S	S
Nitrogen (mg/kg)	460	460	ND	ND	460	ND
Phosphorus (mg/kg)	640	640	ND	ND	640	ND
Total Solids (%)	31	32	39	39	31	39
Volatile Solids (%)	9	9	10	11	8	10
pH Aqueous	7.2	7.2	7.3	7.3	7.3	7.2
pH Slurry	6.6	6.7	6.7	6.7	6.6	6.7
Temperature (^oC)	19	19	19	19	19	19
BTX Solids (mg/kg)	<DL	<DL	<DL	<DL	<DL	<DL
BTX Aqueous (mg/l)	<DL	<DL	<DL	<DL	<DL	<DL
TC Slurry (mg/kg)	49,000	49,000	69,000	64,000	49,000	64,000
TOC Aqueous (mg/l)	58	61	66	58	44	67

Note:

TNC	Too numerous to count
ND	Not Determined
<DL	Less than the detection limit for the analysis
S	Presence of spreading colonies prohibited enumeration
CFU/g	Colony forming unit/gram
Nitrogen	Reported as NH_3-N
Phosphorus	Reported as ortho-phosphate.

Table 4-2
Batch Slurry Study Week 3 Analytical Results

IT Project No. 408491

Analytical Parameter	Treatments					
	1	2	3	4	5	6
Total Heterotrophs (CFU/g)	4.3×10^8	4.1×10^8	2.8×10^8	7.2×10^8	1.2×10^8	TNC
Specific Degraders (CFU/g)	<DL	<DL	<DL	<DL	<DL	<DL
Nitrogen (mg/kg)	410	410	390	390	410	450
Phosphorus (mg/kg)	230	170	270	280	210	270
Total Solids (%)	34	28	39	39	32	38
Volatile Solids (%)	8	7	10	9	9	10
pH Aqueous	6.5	6.5	6.7	6.8	6.5	6.3
pH Slurry	5.6	5.5	5.7	5.8	5.6	5.7
Temperature (°C)	19	19	19	19	19	19
BTX Solids (mg/kg)	<DL	<DL	<DL	<DL	<DL	<DL
BTX Aqueous (mg/l)	<DL	<DL	<DL	<DL	<DL	<DL
TC Slurry (mg/kg)	56,000	54,000	75,000	66,000	54,000	75,000
TOC Aqueous (mg/l)	67	56	71	63	60	65

Note:

TNC	Too numerous to count
ND	Not Determined
<DL	Less than the detection limit for the analysis
CFU/g	Colony forming unit/gram
Nitrogen	Reported as NH_3-N
Phosphorus	Reported as ortho-phosphate.

Table 4-3
Batch Slurry Study Week 6 Analytical Results

IT Project No. 408491

Analytical Parameter	Treatments					
	1	2	3	4	5	6
Total Heterotrophs (CFU/g)	8.8×10^7	1.3×10^8	1.1×10^8	6.0×10^7	2.8×10^8	9.4×10^7
Specific Degraders (CFU/g)	<DL	<DL	<DL	<DL	<DL	<DL
Nitrogen (mg/kg)	340	270	280	270	240	270
Phosphorus (mg/kg)	160	200	190	240	180	250
Total Solids (%)	31	31	39	40	31	39
Volatile Solids (%)	9	9	10	11	8	10
pH Aqueous	6.6	6.8	6.5	6.3	6.8	6.5
pH Slurry	6.4	6.4	6	6	6.4	6
Temperature (°C)	19	19	19	19	19	19
BTX Solids (mg/kg)	<DL	<DL	<DL	<DL	<DL	<DL
BTX Aqueous (mg/l)	<DL	<DL	<DL	<DL	<DL	<DL
TC Slurry (mg/kg)	38,000	35,000	64,000	62,000	42,000	64,000
TOC Aqueous (mg/l)	95	83	120	120	89	110

Note:

TNC	Too numerous to count
ND	Not Determined
<DL	Less than the detection limit for the analysis
CFU/g	Colony forming unit/gram
Nitrogen	Reported as NH_3-N
Phosphorus	Reported as ortho-phosphate.

mercuric chloride. Approximately, 6.8 g of a 7.4 percent, saturated mercuric chloride solution was added to Treatment 5 at study initiation and Week 3. An 8.1 g quantity of the mercuric chloride solution was added to Treatment 6 at study initiation, Week 3, and again during the fourth week of operation. Each addition, resulted in mercuric chloride concentrations of 500 mg/kg in the treatment vessels. Total mercuric chloride concentrations in Treatments 5 and 6 were 1,000 and 1,500 mg/kg, respectively. Mercuric chloride addition did not appreciably affect the slurry volume. Reduced penetration of mercuric chloride throughout the slurry mixture could account for the decreased toxic effect. Experience with other studies suggests that mercuric chloride is the most aggressive sterilant, therefore, other agents would have shown similar results.

The determination of specific-degraders by anthracene spray-plate techniques produced mixed results. Initial determinations could not be made due to the presence of a spreading bacterial colony that interfered with the verification of colony clearing zones. Following initial determinations, Week 3, and Week 6 plates were prepared at higher dilutions to decrease the effect of spreading on the plates. However, due to increased dilution, the detection limit for specific degrader analysis was increased from 10^3 to 10^6 CFU/g. Specific degrader enumerations for Week 3 and Week 6 were less than this detection limit.

Because of the difficulties experienced in determining the specific degraders, radio-labelled anthracene mineralization tests were conducted at Week-3 and Week-6 (Table 4-4) to demonstrate the presence of biological activity. The mineralization study indicated biological activity toward anthracene as measured by $^{14}CO_2$ evolution, with biological activity increasing from Week-3 to Week-6. Details of the mineralization study are included in Appendix E.

Table 4-5 presents the oxygen utilization data for the batch study. The average oxygen uptake rate demonstrated during the study was 12.5 milligrams per liter-hour (mg/l-hr). During the first 3 weeks of operation, final oxygen concentrations in the headspace of biologically-active treatments prior to daily sparging ranged from 89 to 366 mg/l among treatments. Since ambient air is 298 mg/l, many of the treatments were not oxygen limited. In addition, the redox potential of treatment slurries did not indicate anaerobic conditions. Following collection of Week 3 samples, the oxygen concentration and rate of uptake in the biologically-active treatments increased. Redox potentials of slurry samples continued to indicate aerobic conditions were maintained. Aerobic microbial activities are often noted to

Table 4-4
^{14}C-Anthracene Mineralization
Initial Batch Study

IT Project No. 408491

Sample Identification	Percent $^{14}CO_2$ Produced Per Treatment					
	Treatments[1]					
	1	2	3	4	5	6
Week 3	13.8±1.3	16.5±3.6	12.0±0.8	12.0±0.3	16.6±1.9	11.5±0.2
Week 6	23.7±1	22.9±1	23.3±6.1	ND	22.2±0.1	20.1±3.8

ND Not Determined

[1] All data reported as percent $^{14}CO_2$ produced following a 2-week incubation. Samples analyzed were collected during Week-3 and Week-6 batch study sampling events.

Table 4-5
Overall Oxygen Utilization Data
Initial Batch Study

IT Project No. 408491

Treatments	Average Redox Potential[1] (millivolts)		Average Oxygen Uptake Rate (mg/l-hr)	
	Initiation	Week 3	Initiation	Week 3
1	202	254	5	27
2	227	266	5	23
3	143	52	6	25
4	145	22	7	24
5	152	276	5	21
6	141	147	6	26

[1]The electrode used a platinum band with a silver/silver chloride reference cell.

occur most extensively over the transitional redox fringe from -50 to +150 millivolts[38]. Appendix G presents all oxygen and redox measurements made during the batch study.

Analysis of aqueous- and solid-phase samples collected at study initiation, Week 3, and Week 6 showed BTX concentrations less than the detection limit for the analyses. The detection limits for benzene, toluene, and xylene soil analysis were 0.5, 1.2, and 1.5 mg/kg, respectively. The detection limits for benzene, toluene, and xylene aqueous analysis were 12, 23, and 32 micrograms per milliliter (ug/ml), respectively.

The results of TC and TOC analysis of solids and aqueous samples collected during the batch bottle study are presented in Tables 4-1 through 4-3. TC results indicate the organic and inorganic carbon content associated with slurry solids. Initial TC analysis of the 30 and 40 percent treatments averaged 49,000 and 66,000 mg/kg, respectively. Analysis of Week 3 and Week 6 samples collected from the 30 percent treatments indicated average TC concentrations in the solid phase of 55,000 and 38,000 mg/kg, respectively. Analysis of Week 3 and Week 6 samples collected from the 40 percent treatments indicated average TC concentrations in the solid phase of 72,000 and 63,000 mg/kg, respectively. Due to the variability of TC determinations (i.e., 10.6 percent), these data are not indicators of change over time. TC analytical variability was determined by analyzing three identical standards in triplicate.

Initially, aqueous TOC concentrations averaged 54 milligrams per milliliter (mg/l) in the 30 percent and 64 mg/l in the 40 percent treatments; however, these concentrations continued to increase throughout the study. Aqueous TOC concentrations in the 30 percent treatments at Week 3 and Week 6 averaged 61 and 89 mg/l, respectively. Aqueous TOC concentrations in the 40 percent treatments at Week 3 and Week 6 averaged 66 and 120 mg/l, respectively. These data indicate an increase in aqueous organic carbon concentrations (TOC) throughout the study period. This trend may have indicated increased solubilization of soil-bound carbon by biological activity or physical manipulation.

PAH and CPAH determinations are presented in Tables 4-6 through 4-8; overall percent removals are illustrated in Table 4-9. The overall substrate utilization rates for PAH and CPAH are presented in Table 4-10. PAH mass removal percentages ranging from 83 to 87 percent among treatments were demonstrated. CPAH mass removals among treatments

Table 4-6
Batch Slurry Study Initial PAH Results

IT Project No. 408491

COMPOUND	Treatments						
	1	2	3	4	5	6	Detection Limits[1] (mg/kg)
Naphthalene	14U	14U	14U	14U	14U	14U	27
Acenaphthylene	15U	15U	15U	15U	15U	15U	29
Acenaphthene	100	96	120	120	96	130	86
Fluorene	19J	18J	23	23	21	28	6.8
Phenanthrene	34	31	45	41	39	53	1.5
Anthracene	22	18	26	24	22	31	0.059
Fluoranthene	320	300	390	360	320	420	7.4
Pyrene	240	220	290	280	240	320	11
Benz(a)anthracene	37	33	43	46	34	45	9.7
Chrysene	43	39	50	67	40	53	4.9
Benzo(b)fluoranthene	140	130	160	160	130	180	4.0
Benzo(k)fluoranthene	20	17	22	20	17	27	5.1
Benzo(a)pyrene	61	56	72	65	56	76	9.3
Dibenz(a,h)anthracene	43	41	49	52	42	59	25
Benzo(g,h,i)perylene	44	40	49	49	43	53	15
Indeno(1,2,3-cd)pyrene	41	37	47	46	40	52	4.5
Total PAH	1,200	1,100	1,400	1,400	1,200	1,600	NA
Total CPAH	430	390	490	510	400	550	NA

Note: All analytical results are presented in mg/kg

[1] - Analytical detection limits were interpolated based on a response sufficient to produce at least a 3:1 signal to noise ratio.

U - Number preceding indicates half of the detection limit for the analysis

J - Number preceding indicates concentration is above the detection limit but below the quantitation limit

NA - Not Applicable.

Table 4-7
Batch Slurry Study Week 3 PAH Results

IT Project No. 408491

COMPOUND	Treatments						
	1	2	3	4	5	6	Detection Limits[1] (mg/kg)
Naphthalene	14U	14U	14U	14U	14U	14U	27
Acenaphthylene	15U	15U	15U	15U	15U	15U	29
Acenaphthene	43U	43U	43U	43U	43U	43U	86
Fluorene	3.5U	3.5U	3.5U	3.5U	3.5U	3.5U	7
Phenanthrene	8J	8J	6J	7J	7J	8J	1.5
Anthracene	5J	5J	5J	5J	5J	5J	0.059
Fluoranthene	30	27	67	50	33	55	7.4
Pyrene	20	19	22	22	19	22	11
Benz(a)anthracene	4.9U	4.9U	23	14	4.9U	4.9U	9.7
Chrysene	2.5U	2.5U	19	13	2.5U	14	5
Benzo(b)fluoranthene	43	42	51	52	45	50	4.0
Benzo(k)fluoranthene	11	11	19	19	14	19	5.1
Benzo(a)pyrene	31	30	31	31	31	31	9.3
Dibenz(a,h)anthracene	13U	13U	13U	13U	25	13U	25
Benzo(g,h,i)perylene	23	21	22	22	22	23	15
Indeno(1,2,3-cd)pyrene	21	19	19	19	20	19	4.5
Total PAH	290	290	370	340	300	340	NA
Total CPAH	150	140	210	180	160	170	NA

Note: All analytical results are presented in mg/kg.

[1] - Analytical detection limits were interpolated based on a response sufficient to produce at least a 3:1 signal to noise ratio.

U - Number preceding indicates half of the detection limit for the analysis.

J - Number preceding indicates concentration is above the detection limit but below the quantitation limit.

NA - Not Applicable.

Table 4-8
Batch Slurry Study Week 6 PAH Results

IT Project No. 408491

COMPOUND	Treatments						
	1	2	3	4	5	6	Detection Limit[1] (mg/kg)
Naphthalene	14U	14U	14U	14U	14U	14U	27
Acenaphthylene	15U	15U	15U	15U	15U	15U	29
Acenaphthene	43U	43U	43U	43U	43U	43U	86
Fluorene	3.4U	8J	8J	3.4U	8J	3.4U	6.8
Phenanthrene	8J	8J	8J	9J	8J	8J	1.5
Anthracene	2J	2J	2J	2J	2J	2J	0.059
Fluoranthene	24	24	27	34	28	39	7.4
Pyrene	21	20	21	24	23	28	11
Benz(a)anthracene	4.9U	4.9U	4.9U	4.9U	4.9U	4.9U	9.7
Chrysene	2.5U	2.5U	7J	9J	2.5U	6J	4.9
Benzo(b)fluoranthene	36	36	54	59	41	52	4.0
Benzo(k)fluoranthene	10	11	23	22	13	20	5.1
Benzo(a)pyrene	29	28	36	35	36	39	9.3
Dibenz(a,h)anthracene	26	28	29	30	31	13U	25
Benzo(g,h,i)perylene	26	24	25	26	24	24	15
Indeno(1,2,3-cd)pyrene	23	23	22	23	22	21	4.5
Total PAH	290	290	340	350	320	330	NA
Total CPAH	160	160	201	210	170	180	NA

Note: All analytical results are presented in mg/kg.

[1] - Analytical detection limits were interpolated based on a response sufficient to produce at least a 3:1 signal to noise ratio.

U - Number preceding indicates half of the detection limit for the analysis.

J - Number preceding indicates concentration is above the detection limit but below the quantitation limit

NA - Not Applicable.

Table 4-9
Batch Study PAH Percent Removal

IT Project No. 408491

COMPOUND	Treatments					
	1	2	3	4	5	6
Naphthalene	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA
Acenaphthene	69	71	76	75	69	79
Fluorene	89	75	80	91	79	93
Phenanthrene	84	85	89	87	88	91
Anthracene	93	93	96	95	94	96
Fluoranthene	96	96	96	94	95	95
Pyrene	95	95	96	95	95	95
Benz(a)anthracene	92	92	92	93	92	94
Chrysene	97	97	91	92	97	93
Benzo(b)fluoranthene	83	83	79	75	79	81
Benzo(k)fluoranthene	61	54	9	NA	38	41
Benzo(a)pyrene	65	67	66	61	53	65
Dibenz(a,h)anthracene	60	51	63	63	45	87
Benzo(g,h,i)perylene	56	58	64	63	61	70
Indeno(1,2,3-cd)pyrene	58	59	68	65	60	73
Total PAH	85	84	85	84	83	87
Total CPAH	75	74	73	72	71	79

Note: NA - Not applicable.

TABLE 4-10
Substrate Utilization Rates (q)

Project No. 408491

Initial Batch Treatments	q (mg Substrate/g TS/day)			
	Total PAH		CPAH	
	q(TS) 1-3	q(TS) 1-6	q(TS) 1-3	q(TS) 1-6
1	0.041	0.021	0.012	0.006
2	0.040	0.020	0.012	0.006
3	0.050	0.025	0.014	0.007
4	0.049	0.024	0.015	0.007
5	0.041	0.021	0.011	0.006
6	0.058	0.029	0.018	0.009
Average 30%	0.041	0.021	0.012	0.006
Average 40%	0.052	0.026	0.016	0.008
Bioslurry Reactor Study[a]	q (TS)		q (TS)	
1/25 - 2/18	0.031		0.006	
2/19 - 4/1	0.023		0.004	
1/25 -4/1	0.027		0.005	
4/2 - 5/4	0.011		0.005	

[a] - Substrate utilization rates for the bioslurry reactor investigation are averages of daily removals.

ranged from 71 to 79 percent. Mass removal was determined by calculating the mg of PAH and CPAH loaded into the reactor, determining an adjusted initial loading by subtracting any abiotic losses due to sampling from the initial mass, subtracting the final mg of PAH and CPAH which included mass of adsorbed contaminant from the adjusted initial mass, dividing by the adjusted initial mass, and multiplying by 100 to determine the percent lost. No attributable difference in PAH or CPAH removal efficiencies was demonstrated between treatments.

CPAH constituents (i.e., benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene) were found to be the most recalcitrant to biodegradation. All other PAH were effectively degraded. Figures 4-1 and 4-2 illustrate the PAH and CPAH concentrations achieved during batch study treatment.

Substrate utilization rates prior to Week 3 averaged 0.041 mg PAH/g TS/day in the 30 percent treatments and 0.052 mg PAH/g TS/day in the 40 percent treatments. CPAH removal rates averaged 0.012 mg CPAH/g TS/day in the 30 percent treatments and 0.016 mg CPAH/g TS/day in the 40 percent treatments during the first 3 weeks. Substrate utilization of both PAH and CPAH decreased between Week 3 and Week 6. Table 4-10 displays PAH and CPAH substrate utilization from study initiation to Week 3 and the total treatment period. These data support the hypothesis that the majority of PAH biodegradation occurred during the first 3 weeks of operation. Substrate removal from Week 3 through Week 6 was negligible.

4.1.2.2 Bioslurry Reactor Study

During the 3-month bioslurry reactor investigation, the system was operated initially in continuous-flow and, subsequently, in batch mode. The reactor was inspected, charged with water, and operated to determine the working condition of the equipment. Following this initial inspection, the reactor was charged with 60 l of 30 percent slurry and operated in batch for 2 days prior to beginning continuous flow operation. Initial batch operation of the reactor was conducted upon the recommendation of the equipment distributor, Eimco Process Equipment Company (Eimco).

Figure 4-1

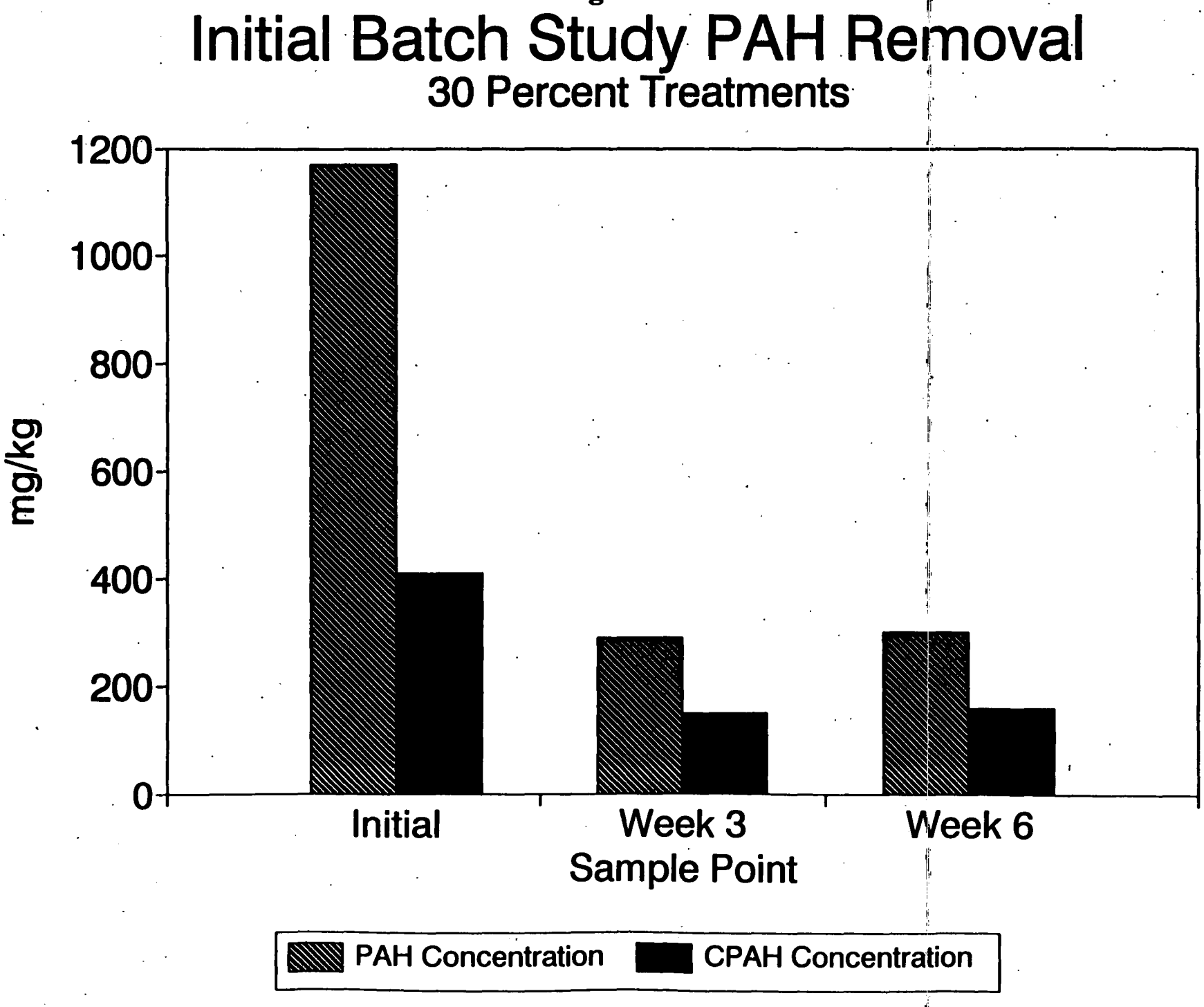
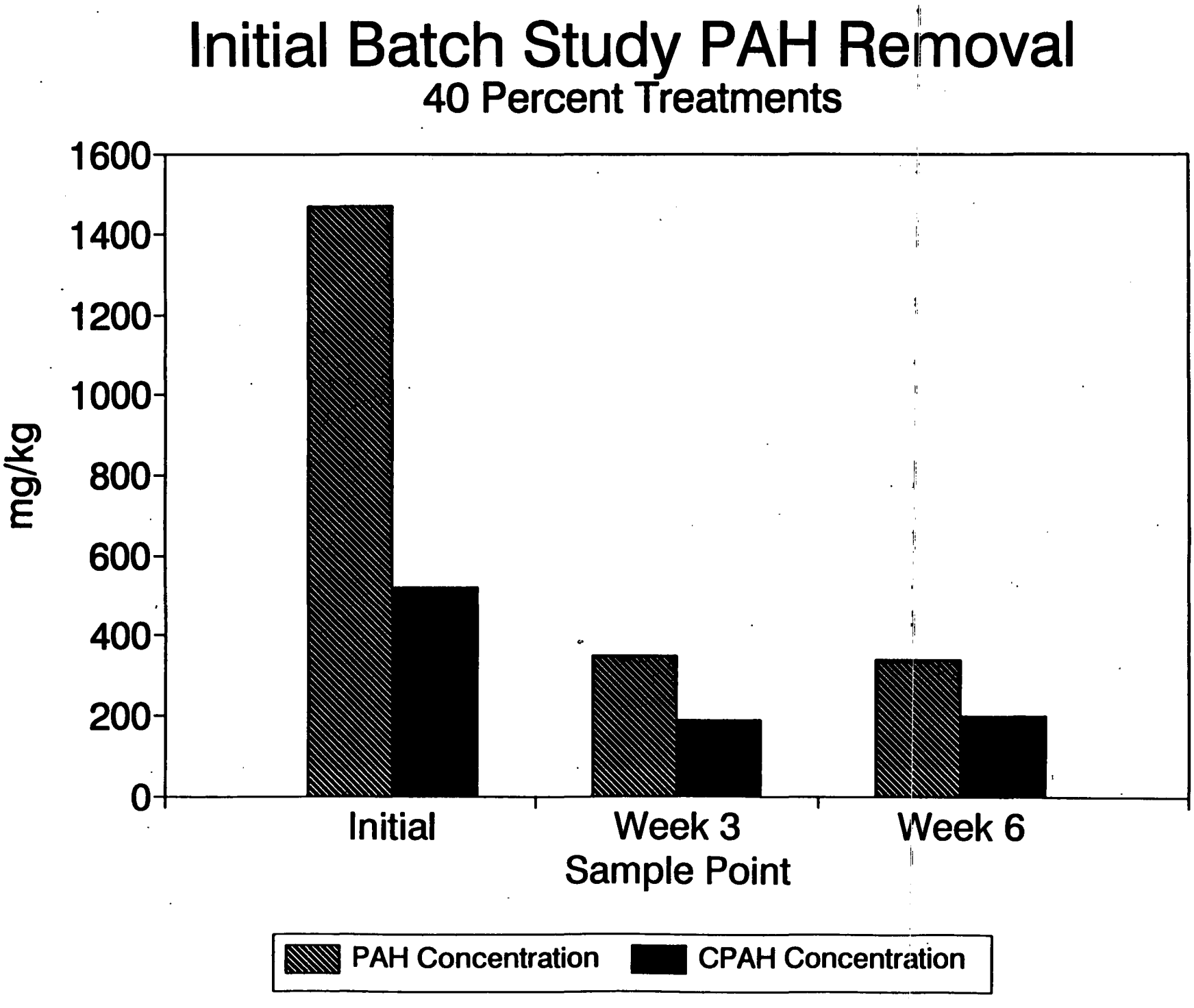

Initial Batch Study PAH Removal
30 Percent Treatments
1200
1000
800
600
400
200
0
mg/kg
Initial
Week 3
Week 6
Sample Point
PAH Concentration
CPAH Concentration

Figure 4-2


Initial Batch Study PAH Removal
40 Percent Treatments
1600
1400
1200
1000
800
600
400
200
0
mg/kg
Initial
Week 3
Week 6
Sample Point
PAH Concentration
CPAH Concentration

System performance was determined primarily through reduction in solids-phase PAH concentrations, specifically the carcinogenic species. The sampling and analytical schedule and methods employed during bioslurry reactor testing are provided in Chapter 3.0.

Tables 4-11 through 4-13 provide all operational data generated during the bioslurry reactor study. The macronutrient concentrations were maintained at adequate levels for biological activity with average slurry-phase nitrogen and ortho-phosphate concentrations of 140 and 210 mg/kg, respectively. The system pH shifted toward acidity during operation of the reactor and was allowed to stabilize at 6.3. The system dissolved oxygen concentration increased to 6.6 mg/l, possibly due to reduced microbial demand.

Aeration was accomplished in the bioslurry reactor through a diffusor, air lift, and impeller. The daily and average set points for these items is provided in Table 4-12. The operating temperature for the system averaged 22°C during the course of the investigation.

TS/VS analysis of the influent, reactor, effluent, and return activated sludge (RAS) slurries is presented in Table 4-13. The average influent and reactor slurry TS concentrations for the continuous-flow period of operation were 30 and 32 percent, respectively. Effluent and RAS TS concentrations averaged 27 and 41 percent, respectively, allowing for the maintenance of a 38-day system biological solids retention time (BSRT). The VS:TS ratio in the reactor slurry averaged 26 percent during both continuous-flow and batch operation. This is within the range observed during the batch bottle study. The average VS:TS ratio for the initial batch bottle study ranged from 23 to 29 percent.

Geotechnical analysis was conducted to determine the impact of particle size distribution on the rate and extent of PAH removal in the reactor system. These analyses are included in Appendix H. Overall, the particle size distribution during continuous-flow operation did not significantly change. Particle size analysis was discontinued during batch operation.

Parameters used as indicators of the system's microbiological health are presented in Table 4-11. Although total heterotrophic populations remained high throughout the continuous-flow and batch periods of operation, the naphthalene degraders, as measured by gene-probe analysis, were less than the 10^6 CFU/g detection limit. In addition, anthracene mineralization testing during batch operation of the reactor indicated 21.2 percent

Table 4-11
Analytical Data
Weston Bioslurry Reactor
IT Project No. 408491

(Page 1 of 4)

Date	NH3-N mg/kg	oPO4 mg/kg	NH4Cl Added (gm)	KH4PO4 Added (mg/kg)	O2 UP mg/L-hr	Hetero. CFU/gm	Specific CFU/gm	TOC(aq) mg/L	TC(solids) mg/kg
1/25									50000.00
1/26					9.90				
1/27	0.60	193.00						200.30	43000.00
1/28						1.30e+09	<2.0e+07		
1/29									
1/31									
2/1	0.70	224.00	68.80	0.00	8.30	1.60e+08	<2.0e+06	64.80	49500.00
2/2									
2/3									
2/4	204.00	151.00						61.10	43000.00
2/5									
2/7									
2/8	149.00	241.00				2.60e+08	<2.0e+06	59.80	43000.00
2/9					8.09				
2/10									
2/11	41.50	176.00						60.70	42500.00
2/12			68.80	0.00					
2/15	129.00	120.00					<2.0e+05	56.00	45000.00
2/16					8.60	6.70e+07			
2/17									

Table 4-11 (continued)
Analytical Data
Weston Bioslurry Reactor
IT Project No. 408491

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Date	NH3-N mg/kg	oPO4 mg/kg	NH4Cl Added (gm)	KH4PO4 Added (mg/kg)	O2 UP mg/L-hr	Hetero. CFU/gm	Specific CFU/gm	TOC(aq) mg/L	TC(solids) mg/kg
2/18	5.86U	179.00	68.80					63.00	43000.00
2/19									
2/22	43.90	209.00	68.80		3.50	4.40e+07	<2.0e+05	71.20	40500.00
2/23									
2/24									
2/25	12.10	172.70	68.80					85.60	43000.00
2/26									
3/1	170.00	159.00				1.30e+08	<2.0e+06	97.10	38000.00
3/2					5.01				
3/3		217.00	68.80						
3/4	220.00							92.70	39000.00
3/5	137.00								
3/6									
3/8	35.60	183.00	68.80			3.80e+08	<2.0e+06	101.20	46000.00
3/9					6.11				
3/10									
3/11	318.00	188.00						92.00	47000.00
3/12									
3/15	13.80					2.20e+08	<2.0e+06	103.80	43000.00
3/16		241.00	68.80		4.41				

Table 4-11 (continued)
Analytical Data
Weston Bioslurry Reactor
IT Project No. 408491

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Date	NH3-N mg/kg	oPO4 mg/kg	NH4Cl Added (gm)	KH4PO4 Added (mg/kg)	O2 UP mg/L-hr	Hetero. CFU/gm	Specific CFU/gm	TOC(aq) mg/L	TC(solids) mg/kg
3/17									
3/18	346.00	194.00						101.50	37500.00
3/19									
3/22	251.00	210.00				2.60e+08	<2.0e+06	84.89	47000.00
3/23					3.40				
3/24									
3/25	187.00	189.60						81.43	43000.00
3/26									
3/29	0.70	213.00	68.80		6.74	3.60e+08	<2.0e+06	94.20	49000.00
3/30									
3/31									
4/1	155.00	215.00						66.10	51000.00
4/2						3.40e+08		76.00	49000.00
4/5	168.00	249.00			1.70	3.30e+08	<2.0e+06		51000.00
4/6									
4/7									
4/8	79.90	290.00			5.40			91.50	33000.00
4/9									
4/12	44.00	248.00	68.80		2.90	2.40e+08		104.60	
4/13									

Table 4-11 (continued)
Analytical Data
Weston Bioslurry Reactor
IT Project No. 408491

(Page 4 of 4)

Date	NH3-N mg/kg	oPO4 mg/kg	NH4Cl Added (gm)	KH4PO4 Added (mg/kg)	O2 UP mg/L-hr	Hetero. CFU/gm	Specific CFU/gm	TOC(aq) mg/L	TC(solids) mg/kg
4/14									
4/15	277.00	267.00						108.60	
4/16									
4/19	279.00	246.00			3.71	1.20e+08		116.90	
4/20									
4/21									
4/22	187.00	258.00						179.00	
4/23									
4/24									
4/26	283.00	266.00			7.68	7.9e+8	<2.0e+06	114.70	58,000
4/27									
4/28								139.60	46,000
4/29	208.00								
4/30									
5/3									
5/4	200.00	215.00			4.96	2.00e+8	<2.0e+06	78.70	41,000

Table 4-12
Operational Data
Weston Bioslurry Reactor

IT Project No. 408491

Date	pH Std. Units	Temp. oC	DO mg/l	Diffuser scfh	Air Lift scfh	Impeller Set Point	Rakes Set Point	H2O l Added
1/25	NA	21.8	0.2	40	35	4.0	4.0	NA
1/26	NA	23.6	1.8	50	30	9.0	NA	NA
1/27	6.8	24.1	3.6	50	NA	9.0	NA	NA
1/28	7.0	22.4	5.1	50	35	9.0	4.0	NA
1/29	6.8	22	5.6	45	35	8.0	4.0	NA
1/31	NA	NA	NA	NA	NA	NA	NA	2.18
2/1	6.9	21.5	5.3	40	35	7.5	4.0	0.00
2/2	6.8	22	5.8	40	35	7.5	4.0	2.18
2/3	6.6	22	4.2	40	35	7.5	4.0	1.45
2/4	6.7	22.5	5.5	40	35	7.5	4.0	1.45
2/5	6.9	22	6.0	40	35	7.5	4.0	1.45
2/7	NA	NA	NA	NA	NA	NA	NA	2.18
2/8	6.8	23	5.6	40	35	7.5	4.0	1.45
2/9	6.6	22.1	5.8	40	35	7.5	4.0	0.73
2/10	6.6	23	5.4	40	35	7.5	4.0	0.73
2/11	6.7	23.6	6.7	40	35	7.5	4.0	0.73

Table 4-12
Operational Data
Weston Bioslurry Reactor

IT Project No. 408491

Date	pH Std. Units	Temp. oC	DO mg/l	Diffuser scfh	Air Lift scfh	Impeller Set Point	Rakes Set Point	H2O l Added
2/12	6.6	21.9	5.4	40	35	7.5	4.0	0.00
2/15	6.3	22.5	3.9	40	35	7.5	4.0	2.92
2/16	6.4	22	5.1	40	35	7.5	4.0	0.73
2/17	6.3	23.1	7.2	40	35	7.5	4.0	1.45
2/18	6.4	23.3	7.7	40	35	7.5	4.0	1.45
2/19	6.2	24	5.2	40	35	7.5	4.0	0.73
2/22	6.1	23	6.8	40	35	7.5	4.0	3.65
2/23	6.3	24.9	5.6	40	35	7.5	4.0	1.45
2/24	6.1	23.7	5.5	40	35	7.5	4.0	0.73
2/25	6.1	24.1	5.7	40	35	7.5	4.0	1.45
2/26	6.5	24.6	5.3	40	35	7.5	4.0	0.00
3/1	6.3	23.1	7.0	40	35	7.5	4.0	3.60
3/2	6.3	23.1	6.9	40	35	7.5	4.0	1.45
3/3	6.3	22.7	6.9	35	35	7.5	4.0	1.45
3/4	6.4	24	6.6	30	35	7.0	4.0	0.73
3/5	6.4	24	6.5	30	35	7.0	4.0	0.73

Table 4-12
Operational Data
Weston Bioslurry Reactor

IT Project No. 408491

(Page 3 of 5)

Date	pH Std. Units	Temp. oC	DO mg/l	Diffuser scfh	Air Lift scfh	Impeller Set Point	Rakes Set Point	H2O l Added
3/6	6.2	NA	NA	NA	NA	NA	NA	NA
3/8	6.2	23.9	6.3	25	35	7.0	4.0	2.90
3/9	6.5	26.5	6.3	25	35	7.0	4.0	1.45
3/10	6.6	24.8	6.8	20	35	6.5	4.0	0.73
3/11	6.5	24.1	6.6	20	35	6.5	4.0	1.45
3/12	6.4	22.2	7.0	20	35	6.5	4.0	0.32
3/15	6.5	23.1	7.3	20	35	6.5	4.0	0.73
3/16	6.5	24.9	6.7	20	35	6.5	4.0	1.45
3/17	6.4	22.7	7.6	20	35	6.5	4.0	0.00
3/18	6.5	22.3	7.2	20	35	6.5	4.0	1.45
3/19	6.4	22.5	7.3	20	35	6.5	4.0	0.73
3/22	6.5	22.3	8.1	20	35	6.5	4.0	2.90
3/23	6.2	22.1	7.7	20	35	6.5	4.0	0.00
3/24	6.4	23	7.4	20	35	6.5	4.0	0.00
3/25	6.5	23.4	6.9	20	35	6.5	4.0	1.45
3/26	6.6	22.4	7.1	20	35	6.5	4.0	0.00

Table 4-12
Operational Data
Weston Bioslurry Reactor

IT Project No. 408491

(Page 4 of 5)

Date	pH Std. Units	Temp. oC	DO mg/l	Diffuser scfh	Air Lift scfh	Impeller Set Point	Rakes Set Point	H2O l Added
3/29	6.4	23.2	6.4	20	35	6.5	4.0	0.00
3/30	6.4	22.9	6.5	20	35	6.5	4.0	0.00
3/31	6.4	23.7	6.0	16	32	6.5	4.0	1.45
4/1	6.4	22.1	6.0	18	28	6.5	4.0	0.72
4/2	6.2	23.2	6.0	18	30	6.5	4.0	0.00
4/5	6.6	22.2	7.0	18	30	6.5	4.0	2.18
4/6	6.3	22.1	6.9	20	30	6.5	4.0	0.72
4/7	6.3	23	7.0	20	30	6.5	4.0	0.00
4/8	6.4	21.5	7.0	20	32	6.5	4.0	0.73
4/9	6.4	23	7.4	20	30	6.5	4.0	1.45
4/12	6.4	26	8.0	20	30	6.5	4.0	0.00
4/13	6.3	22.2	8.0	10	25	6.5	4.0	0.00
4/14	6.6	21.9	7.8	10	25	6.5	4.0	0.00
4/15	6.4	23.3	7.7	10	25	6.5	4.0	0.00
4/16	6.5	20.8	7.4	10	25	6.5	4.0	1.45
4/19	6.4	22.3	7.8	10	25	6.5	4.0	0.00

Table 4-12
Operational Data
Weston Bioslurry Reactor

IT Project No. 408491

(Page 5 of 5)

Date	pH Std. Units	Temp. oC	DO mg/l	Diffuser scfh	Air Lift scfh	Impeller Set Point	Rakes Set Point	H2O l Added
4/20	6.3	22.3	7.6	10	20	6.5	4.0	0.73
4/21	6.5	22.4	7.3	10	20	6.5	4.0	0.73
4/22								0.00
4/23	6.4	24.5	3.8	10	0	6.5	4.0	0.00
4/24	6.3	21.7	6.7	10	15	6.5	4.0	
4/26	6.3	22.1	6.2	10	15	6.5	4.0	2.18
4/27	6.3	22.5	6.1	10	15	6.5	4.0	0.00
4/28	6.2	23.2	7.6	10	15	6.5	4.0	
4/29	6.3	22.5	7.5	10	15	6.5	4.0	0.00
4/30	6.2	22.2	7.4	10	15	6.5	4.0	1.45
5/3	6.2	23	6.9	10	15	6.5	4.0	0.00
5/4	6.2	22.5	6.2	10	15	6.5	4.0	0.73
AVG	6.3	22.01	6.2	24.7	28.7	6.7	3.8	0.92

Note: DO - dissolved oxygen
SCOG - standard cubic feet per hour
NA - Not Analyzed

Table 4-13
Bioslurry Solids Data
IT Project No. 408491

(Page 1 of 2)

Date	Reactor TS %	Reactor VS %	Influent TS %	Influent VS %	Effluent TS %	Effluent VS %	RAS TS %	RAS VS %	VS:TS %
1/25	26.7	7.3	31.0	8.9	ND	ND	ND	ND	27
1/26	29.9	7.6	31.0	8.9	ND	ND	ND	ND	25
1/27	29.0	8.0	31.0	8.9	ND	ND	31.4	8.2	30
1/28	30.9	8.4	31.0	8.9	28.5	5.5	31.4	8.2	27
1/29	29.3	6.7	31.0	8.9	ND	ND	30.7	7.8	22
2/1	28.4	6.9	29.5	7.6	25.9	7.5	42.0	10.5	24
2/2	30.2	7.8	29.5	7.6	25.9	7.5	42.0	10.5	25
2/4	37.0	8.2	31.3	8.1	26.4	7.5	42.0	10.9	22
2/8	29.2	8.0	29.3	8.1	25.3	7.1	41.9	11.3	27
2/11	29.4	8.1	26.7	8.3	23.2	7.2	42.7	11.2	27
2/15	30.1	9.3	30.9	9.2	26.4	8.0	41.7	12.6	30
2/18	30.7	8.4	28.6	7.5	25.9	7.6	40.0	13.0	27
2/22	29.8	7.8	29.9	7.4	24.5	6.9	40.5	10.6	26
2/25	31.3	9.4	29.9	7.4	25.7	9.0	42.4	11.4	30
3/1	30.8	7.8	31.1	7.9	26.1	6.8	44.0	11.5	25
3/4	31.4	7.3	28.8	4.0	25.3	6.6	43.3	10.7	23
3/8	30.5	8.5	28.6	6.7	25.8	7.6	42.9	11.6	27

Table 4-13 (continued)
Bioslurry Solids Data
IT Project No. 408491

(Page 2 of 2)

Date	Reactor TS %	Reactor VS %	Influent TS %	Influent VS %	Effluent TS %	Effluent VS %	RAS TS %	RAS VS %	VS:TS %
3/11	33.2	9.8	29.1	6.6	25.4	8.1	44.5	11.5	31
3/15	31.7	8.7	28.6	6.9	28.3	7.8	44.8	11.3	27
3/18	32.4	7.5	28.8	5.7	26.7	7.0	44.8	10.4	23
3/22	32.7	9.2	29.6	6.8	26.4	7.9	45.0	11.4	28
3/25	32.9	8.4	28.7	6.4	29.6	7.6	40.7	96.0	25
3/29	35.4	8.0	32.2	5.3	32.5	7.9	41.1	90.0	22
4/1	34.5	9.2	33.6	8.5	32.0	8.7	40.1	10.3	26
4/2	33.4	8.4	0	0	33.4	8.4	0	0	25
4/5	33.6	8.2	0	0	33.6	8.2	0	0	24
4/8	32.8	8.2	0	0	32.8	8.2	0	0	25
4/12	35.5	8.8	0	0	35.5	8.8	0	0	24
4/15	33.5	8.0	0	0	33.5	8.0	0	0	23
4/19	33.1	7.9	0	0	33.1	7.9	0	0	23
4/22	34.0	8.7	0	0	34.0	8.7	0	0	25
4/26	33.5	8.8	0	0	33.5	8.8	0	0	26
4/29	33.9	9.0	0	0	33.9	9.0	0	0	26
5/4	34.5	8.3	0	0	34.5	8.3	0	0	24

mineralization of the spiked compound. This mineralization was comparable to Week 6 results of the initial batch bottle study.

Another important indicator of microbial activity is the oxygen uptake rate (Table 4-11). Oxygen uptake rates were determined by measuring the rate of oxygen depletion from subsamples of reactor slurry. During continuous-flow operation, the oxygen uptake rate averaged 8.7 mg/l-hr during the first 3 weeks of operation and decreased to an average of 4.9 mg/l-hr following this period. The oxygen uptake rate determined during batch operation mimicked the last weeks of continuous-flow operation averaging 4.4 mg/l-hr.

PAH and CPAH concentrations in the influent, reactor, and RAS streams are provided in Tables 4-14 through 4-17, respectively. Overall system performance decreased following the first 30 days of operation (Table 4-18). This time period corresponded with the completion of the first HRT and BSRT set points, as well as the introduction of a new feed batch on February 17, 1993. The influent feed batch was prepared identically to the first batch. As previously noted, PAH/CPAH levels were comparable in the two batches of feed soils. Figure 4-3 illustrates the increase in PAH and CPAH concentrations observed in the bioslurry reactor during continuous-flow and batch operation. PAH and CPAH percent removal during this period averaged 67 and 33 percent, respectively. Average PAH and CPAH concentrations in the treated slurry during this period of operation were 320 and 180 mg/kg, respectively.

Due to reduced PAH and CPAH removal efficiencies demonstrated from February 18 through April 1, 1993, the bioslurry reactor mode of operation was changed to batch. Batch operation was maintained from April 2 through May 4, 1993. PAH and CPAH removal efficiencies during batch treatment were reduced at 17 and 27 percent, respectively (Table 4-18). Average PAH and CPAH concentrations in the treated slurry during batch operation were 720 and 200 mg/kg, respectively.

Bioslurry reactor headspace sampling was conducted and quantified to assist in the calculation of the system's materials balance. Table 4-19 illustrates the reduced concentration of volatiles and semivolatiles identified in the reactor headspace. In addition, aqueous-phase PAH concentrations were determined to be insignificant (Table 4-20). Due to the low levels of both aqueous-phase and headspace PAH, these concentrations were not

Table 4-14
Influent PAH Concentrations
Weston Bioslurry Study

IT Project No. 408491

(Page 1 of 2)

Date	Naphthalene mg/kg	Acenaphthylene mg/kg	Acenaphthene mg/kg	Fluorene mg/kg	Phenanthrene mg/kg	Anthracene mg/kg	Fluoranthene mg/kg	Pyrene mg/kg	B(a)A mg/kg	Chrysene mg/kg	B(b)F mg/kg
1/27	9U	10U	26U	32	81	24	310	250	39	45	56
2/1	9U	10U	26U	27	73	22	260	210	36	41	49
2/4	9U	10U	26U	21	71	20	260	220	32	37	52
2/8	9U	10U	26U	29	77	23	290	240	42	39	57
2/11	9U	10U	26U	31	67	22	260	220	33	44	46
2/15	9U	10U	26U	39	84	25	310	260	41	48	49
2/18	9U	10U	26U	21	76	17	320	390	32	39	49
2/22	34J	10U	26U	40	85	24	280	250	41	40	65
2/25	45J	10U	26U	23	50	15	180	150	27	28	45
3/1	55J	10U	26U	51	110	35	320	300	35	40	37
3/4	71J	17U	18U	48	110	34	310	300	37	40	33
3/8	13U	17U	18U	48	100	41	270	280	37	29	130
3/11	13U	17U	18U	39	98	35	250	230	29	36	50
3/15	13U	17U	18U	47	110	30	290	270	32	38	47
3/18	13U	17U	120	34	96	31	260	290	27	29	120
3/22	13U	17U	110	38	110	34	290	320	32	32	140
3/25	13U	17U	59J	44	100	31	300	320	37	48	32
3/29	13U	17U	18U	38	110	38	290	320	30	32	73
4/1	13U	17U	18U	22	56	21	200	200	31	31	86

Table 4-14 (Continued)

(Page 2 of 2)

Date	B(k)F mg/kg	B(a)P mg/kg	D(a,h)A mg/kg	B(g,h,i)P mg/kg	Indeno mg/kg	2,3 ring mg/kg	4,5,6, ring mg/kg	4 ring mg/kg	5,6 ring mg/kg	Total mg/kg	T.CPAH mg/kg
1/27	32	57	29	25	23	490	550	420	130	1000	300
2/1	28	51	19J	22	20	430	480	360	120	900	270
2/4	28	50	22	18J	19	420	480	370	110	890	260
2/8	29	54	22	21	20	460	520	410	110	990	280
2/11	26	48	25	20	19	420	480	370	110	910	260
2/15	20	45	22	21	21	500	530	420	110	1000	270
2/18	39	28	5.5U	16J	18	480	620	550	70	1100	230
2/22	28	35	20	19J	18	500	520	420	100	1000	270
2/25	25	40	19J	18J	19	350	370	280	90	720	220
3/1	16	34	21	18J	15	610	520	430	90	1100	220
3/4	14	32	15J	10J	15	610	500	420	80	1100	200
3/8	23	35	12J	20	15	510	580	500	80	1090	300
3/11	24	31	10J	16J	14	470	440	370	70	910	210
3/15	28	35	15J	18J	16	530	500	420	80	1000	230
3/18	11	24	12J	19J	14	570	550	480	70	1100	260
3/22	12	27	13J	22	15	610	610	540	70	1200	290
3/25	14	26	15J	22	17	560	530	450	80	1100	210
3/29	19	30	19J	21	15	520	560	470	90	1100	240
4/1	12	33	14J	22	16	350	450	360	90	790	250

U - Number preceeding indicates half of the detection limit for the analysis.
J - Number preceeding indicated concentration is above the detection limit but below the quantitation limit.

Table 4-15
Reactor PAH Concentrations
Weston Bioslurry Study
Continuous-Flow Operation

IT Project No. 408491

Date	Naphthalene mg/kg	Acenaphthylene mg/kg	Acenaphthene mg/kg	Fluorene mg/kg	Phenanthrene mg/kg	Anthracene mg/kg	Fluoranthene mg/kg	Pyrene mg/kg	B(a)A mg/kg	Chrysene mg/kg
1/27	9U	10U	26U	5J	11	6J	93	54	24	27
2/1	9U	10U	26U	5J	8J	4J	24	23	4J	4J
2/4	9U	10U	26U	2U	8J	3J	25	21	10	1U
2/8	9U	10U	26U	2U	8J	2J	29	21	11	1U
2/11	9U	10U	26U	2U	7J	3J	23	18	1U	3J
2/15	9U	10U	26U	7J	11	4J	35	34	5J	8J
2/18	9U	10U	26U	5J	15	4J	64	76	9J	7J
2/22	30J	10U	26U	12J	22	8J	73	66	13	12
2/25	34J	10U	26U	15J	24	11	110	93	13	17
3/1	44J	10U	26U	16J	23	15	140	120	19	22
3/4	49J	17U	18U	17J	31	5J	160	130	19	24
3/8	13U	17U	18U	19J	34	16	150	150	21	19
3/11	13U	17U	18U	15J	35	13	140	120	17	18
3/15	13U	17U	18U	20	45	17	180	160	27	24
3/18	13U	17U	18U	22	51	18	180	200	26	32
3/22	13U	17U	53J	17J	51	20	180	200	22	21
3/25	13U	17U	48J	27	58	23	230	230	30	39
3/29	13U	17U	18U	21	57	28	220	230	23	27
4/1	13U	17U	18U	24	33	24	230	220	35	35

Table 4-15 (Continued)

(Page 2 of 2)

Date	B(b)F mg/kg	B(k)F mg/kg	B(a)P mg/kg	D(a,h)A mg/kg	B(g,h,i)P mg/kg	Indeno mg/kg	2,3 ring mg/kg	4,5,6, ring mg/kg	4 ring mg/kg	5,6 ring mg/kg	Total mg/kg	T.CPAH mg/kg
1/27	50	29	51	17J	22	20	160	290	180	110	450	240
2/1	54	29	50	21	23	22	86	230	120	110	320	210
2/4	48	21	44	18J	20	20	82	200	100	100	280	180
2/8	42	16	40	23	20	20	86	190	90	100	280	170
2/11	28	11	31	20	12J	15	79	140	61	79	220	120
2/15	39	16	40	31	18J	20	100	210	100	110	310	180
2/18	45	27	27	13J	16J	20	130	240	160	80	370	160
2/22	51	18	36	16J	18J	19	180	250	160	90	430	180
2/25	42	15	34	23	17J	19	230	270	180	90	500	180
3/1	40	15	39	18J	14J	19	270	310	220	90	580	190
3/4	37	13	34	15J	13J	18	300	300	220	80	600	170
3/8	47	21	37	15J	23	19	270	350	260	90	620	200
3/11	39	19	28	11J	15J	15	250	280	210	70	530	160
3/15	44	18	30	10J	19J	18	310	350	270	80	660	190
3/18	85	15	32	5U	21	16	320	430	360	70	750	230
3/22	67	13	25	11J	16J	12	350	390	320	70	740	190
3/25	32	14	24	5U	16J	14	410	400	350	50	820	170
3/29	57	20	35	10J	21	17	370	440	360	80	810	210
4/1	92	14	37	23	28	18	360	500	400	100	860	280

U - Number preceeding indicates half of the detection limit for the analysis.
J - Number preceeding indicated concentration is above the detection limit but below the quantitation limit.

Table 4-16
Reactor PAH Concentrations
Weston Bioslurry Study
Batch Operation

IT Project No. 408491

(Page 1 of 2)

Date	Naphthalene mg/kg	Acenaphthylene mg/kg	Acenaphthene mg/kg	Fluorene mg/kg	Phenanthrene mg/kg	Anthracene mg/kg	Fluoranthene mg/kg	Pyrene mg/kg	B(a)A mg/kg	Chrysene mg/kg	B(b)F mg/kg	B(k)F mg/kg
4/2	13U	17U	47J	24	24	22	220	210	32	28	96	14
4/5	13U	17U	18U	20	19	19	170	120	35	46	100	21
4/8	13U	17U	18U	15J	19	17	140	110	27	33	81	19
4/12	13U	17U	18U	19J	18	18	180	170	24	21	27	12
4/15	13U	17U	41J	17J	23	22	220	210	27	27	30	14
4/19	13U	17U	37J	24	21	22	220	220	23	26	31	14
4/22	13U	17U	48J	19J	21	21	210	240	30	24	69	21
4/26	13U	17U	39J	20	20	23	230	250	32	27	40	15
4/29	13U	17U	36J	16J	16	22	210	200	27	25	31	13
5/4	13U	17U	39J	16J	14	22	200	180	29	22	30	13

Table 4-16 (Continued)

(Page 2 of 2)

Date	B(a)P mg/kg	D(a,h)A mg/kg	B(g,h,i)P mg/kg	Indeno mg/kg	2,3 ring mg/kg	4,5,6, ring mg/kg	4 ring mg/kg	5,6 ring mg/kg	Total mg/kg	T.CPAH mg/kg
4/2	34	13J	26	17	370	470	380	90	840	260
4/5	26	10J	21	15	280	390	320	70	670	270
4/8	24	5U	20	14	240	330	270	60	570	220
4/12	28	20	18J	12	280	330	250	80	610	160
4/15	37	20	21	15	350	400	310	90	750	190
4/19	32	10J	17J	12	350	380	310	70	740	160
4/22	35	12J	17J	16	350	460	380	80	810	220
4/26	39	13J	24	17	360	460	360	100	820	210
4/29	27	15J	20	16	330	370	300	70	700	170
5/4	29	14J	20	16	320	350	270	80	670	170

U - Number preceeding indicates half of the detection limit for the analysis.
J - Number preceeding indicated concentration is above the detection limit but below the quantitation limit.

Table 4-17
RAS PAH Concentrations
Weston Bioslurry Study
IT Project No. 408491

(Page 1 of 2)

Date	Naphthalene mg/kg	Acenaphthylene mg/kg	Acenaphthene mg/kg	Fluorene mg/kg	Phenanthrene mg/kg	Anthracene mg/kg	Fluoranthene mg/kg	Pyrene mg/kg	B(a)A mg/kg	Chrysene mg/kg	B(b)F mg/kg	B(k)F mg/kg
1/27	9U	10U	26U	5J	12	6J	110	67	26	33	57	32
2/1	9U	10U	26U	6J	8J	4J	26	24	5J	4J	55	29
2/8	9U	10U	26U	2U	7J	2J	27	19	10	1U	39	15
2/15	9U	10U	26U	7.8J	10J	4J	31	30	4J	8J	38	15
2/22	32J	10U	26U	12J	23	8J	75	68	13	12	45	18
3/1	45J	10U	26U	16J	23	15	140	120	19	23	39	15
3/8	13U	17U	18U	19J	34	17	150	150	22	20	45	20
3/15	13U	17U	18U	19J	46	19	180	160	26	26	45	18
3/18	13U	17U	18U	20J	55	19	190	200	27	31	81	14
3/25	13U	17U	40J	27	59	22	220	210	31	40	31	14
3/29	13U	17U	18U	22	57	28	220	220	20	28	59	20

Table 4-17 (Continued)

(Page 2 of 2)

Date	B(a)P mg/kg	D(a,h)A mg/kg	B(g,h,i)P mg/kg	Indeno mg/kg	2,3 ring mg/kg	4,5,6, ring mg/kg	4 ring mg/kg	5,6 ring mg/kg	Total mg/kg	T.CPAH mg/kg
1/27	58	30	25	23	180	350	220	130	530	280
2/1	50	23	22	21	88	230	120	110	320	210
2/8	37	25	19J	18	85	180	84	96	270	160
2/15	37	29	21	20	89	200	95	100	290	170
2/22	35	14J	18J	19	190	240	160	80	430	170
3/1	38	16J	14J	18	270	300	210	90	570	180
3/8	38	17J	22	19	270	350	260	90	620	200
3/15	30	14J	18J	17	310	350	280	70	670	190
3/18	27	15J	19J	16	330	430	350	80	760	230
3/25	24	5U	17J	14	400	390	330	60	780	180
3/29	35	13J	22	16	370	430	350	80	810	210

U - Number preceeding indicates half of the detection limit for the analysis.
J - Number preceeding indicated concentration is above the detection limit but below the quantitation limit.

Table 4-18
Average PAH Removal Based on
Influent and Effluent Concentrations
Bioslurry Reactor Operation

IT Project No. 408491

Compound	Percent Removal		
	1/25 - 2/18	2/22 - 4/1	4/1 - 5/4
2,3 Ring	78	42	14
4,5,6 Ring	58	31	17
4 Ring	71	36	16
5,6 Ring	16	0	12
Total PAH	67	26	17
CPAH	33	17	27

Figure 4-3

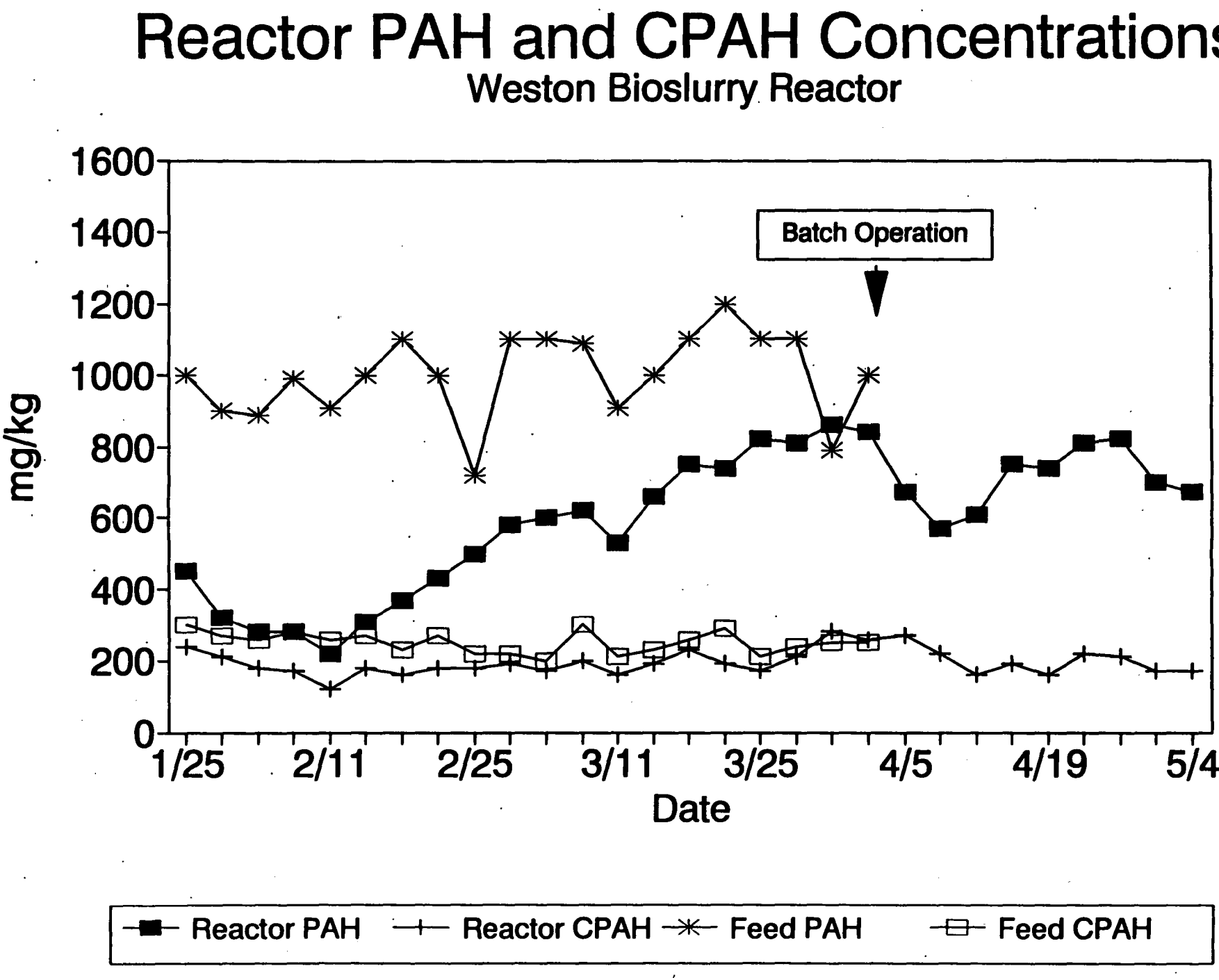
Reactor PAH and CPAH Concentrations
Weston Bioslurry Reactor
Batch Operation
mg/kg
1600
1400
1200
1000
800
600
400
200
0
1/25
2/11
2/25
3/11
3/25
4/5
4/19
5/4
Date
Reactor PAH
Reactor CPAH
Feed PAH
Feed CPAH

Table 4-19
Headspace Analysis of Bioslurry Reactor

IT Project No. 408491

Compound	Date Collected	Concentration (mg/l)
Naphthalene	3/18/93	2.78×10^{-6} J
	3/25/93	2.78×10^{-6} J
Acenaphthene	2/25/93	2.78×10^{-6} J [a]
	3/4/93	5.56×10^{-6} J
	3/11/93	5.56×10^{-6} J
	3/18/93	5.56×10^{-6} J
	3/25/93	1.39×10^{-5} J
	4/1/93	1.39×10^{-5} J
	4/8/93	2.21×10^{-5} J
	4/17/93	5.56×10^{-6} J
Dibenzofuran	4/8/93	8.3×10^{-6} J
Fluorene	4/8/93	8.3×10^{-6} J
	4/17/93	2.78×10^{-6} J
n-Pentane	2/12/93	1.1×10^{-3}
	2/25/93	1.3×10^{-3}
	4/9/93	3.8×10^{-3}
Methylene Chloride	2/12/93	2.8×10^{-2}
	2/18/93	1.8×10^{-1}
	2/25/93	9.3×10^{-2}
	3/4/93	5.3×10^{-2}
	3/11/93	1.9×10^{-2}
	3/18/93	2.9
	3/25/93	9.4×10^{-2} B
	4/1/93	4.0×10^{-2} B
	4/9/93	9.0×10^{-2}
	4/16/93	9.6×10^{-1}
Hexane	2/18/93	1.0×10^{-3} J
	2/25/93	5.0×10^{-4} J
	3/4/93	2.0×10^{-3} J
	3/25/93	1.0×10^{-3} J
	4/1/93	7.0×10^{-4} J
	4/9/93	1.8×10^{-3}

Table 4-19
Headspace Analysis of Bioslurry Reactor

IT Project No. 408491

Compound	Date Collected	Concentration (mg/l)
1,1,1-Trichloroethane	2/12/93	3.8×10^{-3}
	2/18/93	2.1×10^{-2}
	2/25/93	1.2×10^{-1}
	3/4/93	2.0×10^{-1}
	3/18/93	2.3×10^{-3}
	3/25/93	5.5×10^{-3}
	4/1/93	6.6×10^{-1}
	4/9/93	5.0×10^{-3}
1,1,2-Trichloro-1,2,2-trifluoroethane	4/1/93	3.7×10^{-3}
Benzene	2/12/93	8.0×10^{-4} J
	2/18/93	8.0×10^{-4} J
	2/25/93	7.0×10^{-4} J
	3/25/93	9.0×10^{-4} J
	4/1/93	6.0×10^{-4} J
	4/9/93	1.5×10^{-3}
n-Heptane	4/9/93	1.0×10^{-3}
Toluene	2/12/93	1.6×10^{-3}
	2/18/93	2.1×10^{-3}
	2/25/93	2.4×10^{-3}
	3/4/93	2.8×10^{-3} J
	3/18/93	3.1×10^{-3}
	3/25/93	3.2×10^{3}
	4/1/93	1.7×10^{-3}
	4/9/93	3.8×10^{-3}
n-Octane	2/12/93	4.0×10^{-4} J
n-Pentane	3/25/93	1.2×10^{-3}
	4/1/93	2.1×10^{-3}
m/p-Xylene	2/25/93	5.0×10^{-4} J
	3/25/93	7.0×10^{-4} J
Chlorodifluoromethane	3/25/93	2.3×10^{-3}
n-Nonane	2/12/93	4.0×10^{-4} J
Decane	2/12/93	1.0×10^{-3}
	2/18/93	9.0×10^{-4} J
	2/25/93	5.0×10^{-4} J

Industry

Farm Field

Wetland

Wetland

Residential Apartments

BROWN DEER ROAD

107th STREET

Farm Field

C & NW RAILROAD

Small Businesses

GRANVILLE ROAD

TREATED STORAGE

SETTLING PONDS

FILL

DREDGINGS

NORTHEAST LANDFILL

SLUDGE DISPOSAL (?)

SOLID WASTE PILE

SOUTHEAST LANDFILL

Undeveloped

Wooded

Wooded

Residences

PROCESS VICINITY (INCLUDES PART OF DRIP TRACKS)

Landfill

PROCESS AREA

Auto Junkyard

WISCONSIN & SOUTHERN RAILROAD

TREATED STORAGE

Farm Fields

LEGEND

- SITE BOUNDARY
- 140 — SAMPLE LOCATION AND CARCINOGENIC PAH CONCENTRATION (mg/kg) — CH2MHILL'S DATA
- ND = NONE DETECTED
- CONTAMINATED AREA
- TP 2 — APPROXIMATE LOCATION OF WESTON TEST PITS

N

0 300

APPROXIMATE SCALE IN FEET

DRAFT

FIGURE ADAPTED FROM FS REPORT BY CH2MHILL, INC. MAY 1990

WESTON MANAGERS DESIGNERS/CONSULTANTS

Three Hawthorn Parkway
Vernon Hills, Illinois
60061

FIGURE 1

LOCATION OF TREATABILITY STUDY SAMPLING TEST PITS

MOSS-AMERICAN SITE
Milwaukee, Wisconsin

Table 4-19
Headspace Analysis of Bioslurry Reactor

IT Project No. 408491

Compound	Date Collected	Concentration (mg/l)
n-Undecane	2/12/93	1.3×10^{-3}
	2/18/93	1.0×10^{-3} J
	2/25/93	6.0×10^{-4} J
	3/25/93	1.1×10^{-3}
	4/1/93	7.0×10^{-4} J
n-Dodecane	2/12/93	1.0×10^{-3}
	2/25/93	5.0×10^{-4} J
	3/25/93	1.4×10^{-3}
	4/1/93	9.0×10^{-4}
1,2,4-Trimethylbenzene	2/12/93	4.0×10^{-4} J

[a] - Assumed flow rate of 24 hours.
J - Estimated value
B - Compound present in sample blank.

Table 4-20
PAH Analysis of Bioslurry Water Samples

IT Project No. 408491

Compound	Date	Sample Point		
		Influent (mg/l)	Reactor (mg/l)	RAS (mg/l)
Fluorene	3/11/93	0.03	<DL	ND
	3/15/93	<DL	<DL	0.03
	3/18/93	<DL	0.03	ND
	4/1/93	0.05	0.04	ND
Phenanthrene	2/1/93	<DL	<DL	0.012
	2/8/93	<DL	<DL	0.018
	2/11/93	0.016	<DL	ND
	2/15/93	0.015	<DL	<DL
	2/18/93	0.015	<DL	ND
	2/22/93	0.014	<DL	<DL
	3/1/93	0.016	<DL	<DL
	3/8/93	0.01	<DL	<DL
	3/18/93	<DL	0.01	ND
	3/25/93	0.01	<DL	<DL

ND - Not Determined
<DL - Less than the detection limit for analysis

Table 4-21
Metals and Sulfide Analysis
Bioslurry Reactor Study

IT Project No. 408491

Sample Identification	Arsenic (mg/kg)	Barium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Lead (mg/kg)	Sulfide (mg/kg)
Reactor Effluent (1/25 - 2/15)	11.8	45.5	1.7	8.4	32.0	480
Final Bottle Study (Influent 3/26)	35.3	61.7	1.2	8.1	29.6	NA
Reactor Slurry 5/4	27.2	62.9	1.8	10.0	32.4	140
Week 6 30% Composite Initial Batch Study	20.0	64.5	3.2	10.0	43	520

NA - Not Analyzed

TABLE 4-22
PAH Analytical Results
Final Batch Study

Project No. 408491

Parameter	Initial Analysis	Week 3	Week 6	Percent Removal
PAH (mg/kg)	1,100	490	390	65
CPAH (mg/kg)	210	170	150	29
Total Heterotrophs (CFU/gm)	2.2×10^8	3.3×10^8	5.0×10^6	ND
Gene Probe (CFU/gm)	$<2.0 \times 10^6$	NA	$<2.0 \times 10^4$	ND
Oxygen Uptake (mg O_2/l-hr)	32.1	5.0	ND	ND

NA - Not Analyzed
ND - Not Determined.

included in the system's material balance. Some of the constituents detected (e.g., methylene chloride, trichloroethane, and freon) may have been introduced via the reactor's aeration system.

PAH and CPAH mass removal during the first 4 weeks of continuous-flow operation averaged 1.5 and 1 g/day, respectively. This rate of removal decreased to a daily average of 0.5 and 0.3 g of PAH and CPAH, respectively, during the remaining period of continuous-flow operation. PAH and CPAH mass removals during batch operation averaged 0.5 and 0.2 g/day, respectively. Appendix I provides the detailed mass removal and substrate utilization calculations.

Substrate utilization rates (q) based on mass of PAH and CPAH removed are provided in Table 4-10 and Appendix I. Substrate utilization determined during the first 4 weeks of operation (i.e., January 25 through February 18, 1993) averaged 0.031 mg PAH removed/g TS/day and 0.006 mg CPAH removed/g TS/day. In comparison to the batch bottle study, these rates are less than those determined for the first 3 weeks of operation in the 30 percent treatments. Following 4 weeks of continuous-flow operation, the PAH and CPAH utilization rates decreased to 0.023 and 0.004 mg removed/g TS/day, respectively. Batch operation resulted in a continuing decrease to 0.011 mg PAH removed/g TS/day; CPAH utilization remained unchanged at 0.005 mg/g TS/day.

Due to the reduction in system performance several additional analyses were conducted to help elucidate the nature of system stress. These analyses included determination of volatile organic compounds (VOC), metals and sulfide concentrations, and halogenated organics present (Appendix H). Table 4-21 presents the results of the metals and sulfide analyses. No problematic compounds or concentrations were detected during analysis.

4.1.2.3 Final Bottle Study

A final bottle study was conducted to generate data on the biological treatment of the second soil shipment which would be comparable to data generated on the first soil shipment. The results of the final bottle study are presented in Table 4-22. This study employed February 17, 1993 bioslurry reactor feed stock to determine the impact of this material on reactor operation. The influent sample was chosen for testing to determine if the second feed batch was inhibitory.

Results of the study indicated that PAH and CPAH percent removals based on concentration were 65 and 29, respectively. These results were less than those determined during the initial batch study.

4.1.3 Comparison to Test Objectives

4.1.3.1 Batch Bottle Study

The objectives of this study included:

- Providing support data for enhanced operation of the bioslurry reactor
- Determination of the impact of solids loading on operation
- Calculation of preliminary substrate utilization rates.

Data generated during the initial batch bottle study provided support for the start-up, operation, and evaluation of the bioslurry reactor system. The data generated allowed for the determination of solids loading impact on reactor operation. Although the CPAH substrate removals in the 30 and 40 percent treatments were similar, the physical nature of the 40 percent slurry would not allow for sufficient mixing. A maximum slurry density of 35 percent was determined to be appropriate for suspension in the bioslurry reactor during an initial slurry evaluation conducted by Eimco. Therefore, a 30 percent solids loading was chosen for bioslurry reactor operation.

Substrate utilization rates were determined based on PAH and CPAH removal. These data are presented in Table 4-10. Maximum substrate removal occurred during the first 3 weeks of operation. The 30-day HRT for reactor operation encompassed this period of activity.

4.1.3.2 Bioslurry Reactor Study

The objectives of the bioslurry investigation included:

- Estimation of hydraulic retention time (HRT) and BSRT set points for operation
- Determination of the efficacy of meeting the specified treatment standard
- Identification of requirements for additional physical/chemical pretreatment
- Generation of performance data upon which pilot-scale design could be established.

The bioslurry reactor was maintained at a 30-day HRT and 38-day BSRT for 68 days of continuous-flow operation. Due to the reduced performance of the reactor during both

continuous-flow and batch operation, optimal HRT and BSRT set points could not be estimated.

CPAH removal efficiencies determined during both continuous-flow and batch operation did not result in final soil CPAH concentrations near the mandated target concentration of 6.1 mg/kg total CPAH.

4.2 Quality Assurance/Quality Control

The quality level for these investigations was Level III, as described in "Guide for Conducting Treatability Studies Under the Comprehensive Environmental Response, Comprehensive and Liability Act (CERCLA)" EPA/540/2-89/058[39]. This level was selected to provide high quality analytical results without using Contract Laboratory Program (CLP) analyses.

Data collected during execution of the study were recorded in a bound, controlled laboratory notebook. Data generated from integrators and computerized instruments were printed with the resulting data sheets kept with the project file. All data were verified and checked by a Biotechnology Applications Center (BAC) scientist. Proof of verification is the dated signature of the checker at the bottom of each notebook page.

To provide evidence of work performance and the basis for information presented in the Technical Memorandum, numerical analyses and results were documented and filed in IT Corporation (IT)-Knoxville central files. Documentation included calculations, computer programs, and associated input/output logs, drawings, and tables. Analytical activities were performed in a planned and controlled manner. An U.S. Environmental Protection Agency (EPA)-approved Test Plan was employed.

Calculations were legible and in a form suitable for reproduction, filing, and retrieval. Calculations were performed on standard calculation paper or in laboratory notebooks. Computer programs were documented in sufficient detail to satisfy requirements, needs, and intended use of the program.

4.2.1 Internal QC Checks

QA audits and surveillances of the IT-Knoxville central files and BAC laboratory were

performed by an IT QA Officer. An IT audit report, issued on April 7, 1993, is presented in Appendix J. Following issuance of the report, a meeting of all BAC staff and ITAS auditors was held to discuss the audit's observations. The BAC response to these observations is also included in Appendix J.

4.2.2 Data Quality Checks

A total of 77 PAH soil analyses were conducted during the batch and bioslurry investigations. In addition, 27 matrix spikes and method blanks were analyzed.

The QC checks consisted of 12 method blanks and 15 matrix spike analyses. Method blanks were analyzed for both CPAH and total PAH; no compounds were detected. Matrix spikes analyses resulted in the recovery percentages provided in Appendix H.

A three-point rather than five-point calibration curve was used during PAH analysis. All PAH analyses that fell outside of the linear range of the three-point calibration curve were reported as estimated values.

A third party laboratory standards check was also analyzed at the end of the bioslurry reactor study prior to the analysis of final bottle study samples, to demonstrate the effectiveness of the analytical instrumentation. The results of the standard check are provided in Appendix H.

Surrogate additions were not conducted in BAC analysis of PAH samples. Surrogate addition analysis was conducted while employing EPA Methods 8240, 6010, 8010, and 8270 for sample analysis.

4.3 Key Contacts

Key technical contacts for the described project include:

- Kandi Brown, IT Project Manager, (615) 690-3211
- Bill Lowe, Weston Technical Manager, (215) 344-3762
- Gary Deigan, Weston Project Manager, (708) 918-4114.

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APPENDIX A
INITIAL CHARACTERIZATION DATA FOR TREATABILITY STUDY MATRIX

Moss-American Site
Milwaukee, Wisconsin

Initial Characterization Data for Treatability Study Test Matrix

(Predesign Task 16 - Bioslurry and Soil Washing Phase I Treatability Evaluation)

4 November 1992

(Amended January 1993)

Table 1

Summary of Test Pit Composite Samples Evaluated for Selection of Treatability Test Matrix

Composite Sample	Test Pits Sampled to Form Composite	Total CPAH Concentration (mg/kg)
S01	TP12, TP13, TP14, and TP15	57.4
S02	TP8	506.7
S03	TP3	197.4
S04	TP12, TP13, TP14, TP15, TP8, TP3	122.8

Notes:

- Composite samples "S02" and "S03" were selected as the treatability study test matrix designated as "IT-TS01" (Bioslurry) and "BRG-TS01" (Soil Washing).
- A second soil washing treatability study test matrix was formulated by compositing samples from test pits designated as TP4, TP5, TP6, TP11, TP12, and TP15. This test matrix is designated as "BRG-TS02".

Table 2

Summary of Bioslurry and Soil Washing
Treatability Study Sample Chemical Characterization
Moss-American Site
Milwaukee, Wisconsin

Parameter	Units	Sample Designation		
		IT-TS01	BRG-TS01	BRG-TS02
% Solids	%	65.4	58.8	85.1
Total Organic Carbon	%	6.1	6.6	6.2
pH	pH Units	6.9	7.1	NA
PURGEABLE AROMATICS				
Benzene	ug/kg	ND	ND	ND
Ethylbenzene	ug/kg	ND	ND	ND
Toluene	ug/kg	ND	ND	ND
Xylene (total)	ug/kg	ND	ND	ND

NA - Not applicable (parameter not analyzed).
ND - Analyzed-not detected.

Table 2

Summary of Bioslurry and Soil Washing
Treatability Study Sample Chemical Characterization
Moss-American Site
Milwaukee, Wisconsin
(Continued)

Parameter	Units	Sample Designation		
		IT-TS01	BRG-TS01	BRG-TS02
PAH				
Naphthalene	ug/kg	23,000	30,000	57,000
Acenaphthylene	ug/kg	180,000	170,000	120,000
Acenaphthene	ug/kg	130,000	83,000	18,000
Fluorene	ug/kg	34,000	23,000	2,300[1]
Phenanthrene	ug/kg	120,000	87,000	16,000
Anthracene	ug/kg	220,000	220,000	5,800
Fluoranthene	ug/kg	320,000	210,000	38,000
Pyrene	ug/kg	180,000	160,000	24,000
Benzo(a)anthracene	ug/kg	30,000	27,000	3,700
Chrysene	ug/kg	96,000	100,000	12,000
Benzo(b)fluoranthrene	ug/kg	33,000	48,000	12,000
Benzo(k)fluoranthrene	ug/kg	9,000	4,100	3,600
Benzo(a)pyrene	ug/kg	34,000	36,000	8,300
Dibenzo(a,h)anthracene	ug/kg	8,900	8,600	610
Benzo(ghi)perylene	ug/kg	12,000	11,000	10,000
Indeno(1,2,3-cd)pyrene	ug/kg	11,000	10,000	9,100
Total PAH	mg/kg	1,440.9	1,227.7	340.41
Total CPAH	mg/kg	233.9	244.7	59.31

NA - Not applicable (parameter not analyzed)
[1] - Analyzed-not detected at the detection limit of 4,700 µg/kg. For purposes of calculating total PAH/CPAHs, one-half the detection limit has been reported.

Table 3

Geotechnical Tests Performed, Reference Methods and Test Numbers

Test Parameter	Method[1]
Grain Size by Sieve and Hydrometer	D 421/422
Liquid and Plastic Limits	D 4318
Total Porosity	D 854/2937
Natural Moisture Content	D 2216

WESTON ENVIRONMENTAL TECHNOLOGY LABORATORY

GEOTECHNICAL TESTING DATA AND RESULTS

PROJECT	KERR-McGEE	PROJECT SAMPLE I.D.	BRG-TSO2	PROJECT ANALYST	SPM
JOB NUMBER	92100004	ETL SAMPLE NUMBER	001	QA/QC ANALYST	RWF
W. O. NUMBER	02687-007-001	DATE RECEIVED	10/26/92	DATE COMPLETED	11/09/92

PARTICLE SIZE DISTRIBUTION

U. S. Standard Sieve Size	Diameter mm	% Finer
3"	75.00	100.0
1 1/2"	37.50	100.0
3/4"	19.00	100.0
3/8"	9.500	95.4
#4	4.750	83.1
#10	2.000	67.7
#20	0.850	55.0
#50	0.300	41.8
#100	0.150	34.4
#200	0.075	30.1
HYDROMETER	0.0502	23.2
	0.0360	21.3
	0.0262	17.4
	0.0187	15.5
	0.0140	11.7
	0.0100	10.7
	0.0072	6.9
	0.0051	5.9
	0.0036	5.9
	0.0026	4.0
	0.0014	3.1
	0.0011	2.1

EFFECTIVE SIZES

% Finer	Diameter mm
60	1.304
30	NA
10	NA
Uniformity Coefficient	Gradation Coefficient
NA	NA

NATURAL MOISTURE CONTENT

% dry basis	% wet basis
37.1	27.1

TOTAL SOLIDS

% by weight: 72.9

SPECIFIC GRAVITY

2.37

SAMPLE DESCRIPTION

brown gravelly silty SAND with 17% gravel and 30% silt of slight plasticity

Unified Soil Classification System (USCS) Group Symbol: SM

INDEX PROPERTIES

% moisture dry basis

Liquid Limit	Plastic Limit	Plasticity Index
44.6	38.2	6.4

BULK UNIT WEIGHT (disturbed, uncompacted)

wet g/cc	wet pcf	dry pcf
1.1	70.5	51.4

POROSITY

Void Ratio	Porosity,%	Saturation,%
1.9	65.3	46.9

NOTES

NA=NOT APPLICABLE

WESTON ENVIRONMENTAL TECHNOLOGY LABORATORY

PARTICLE-SIZE DISTRIBUTION CURVE FOR
KERR-MCGEE PROJECT SAMPLE BRG-TSO2, ETL SAMPLE # 921000004-001

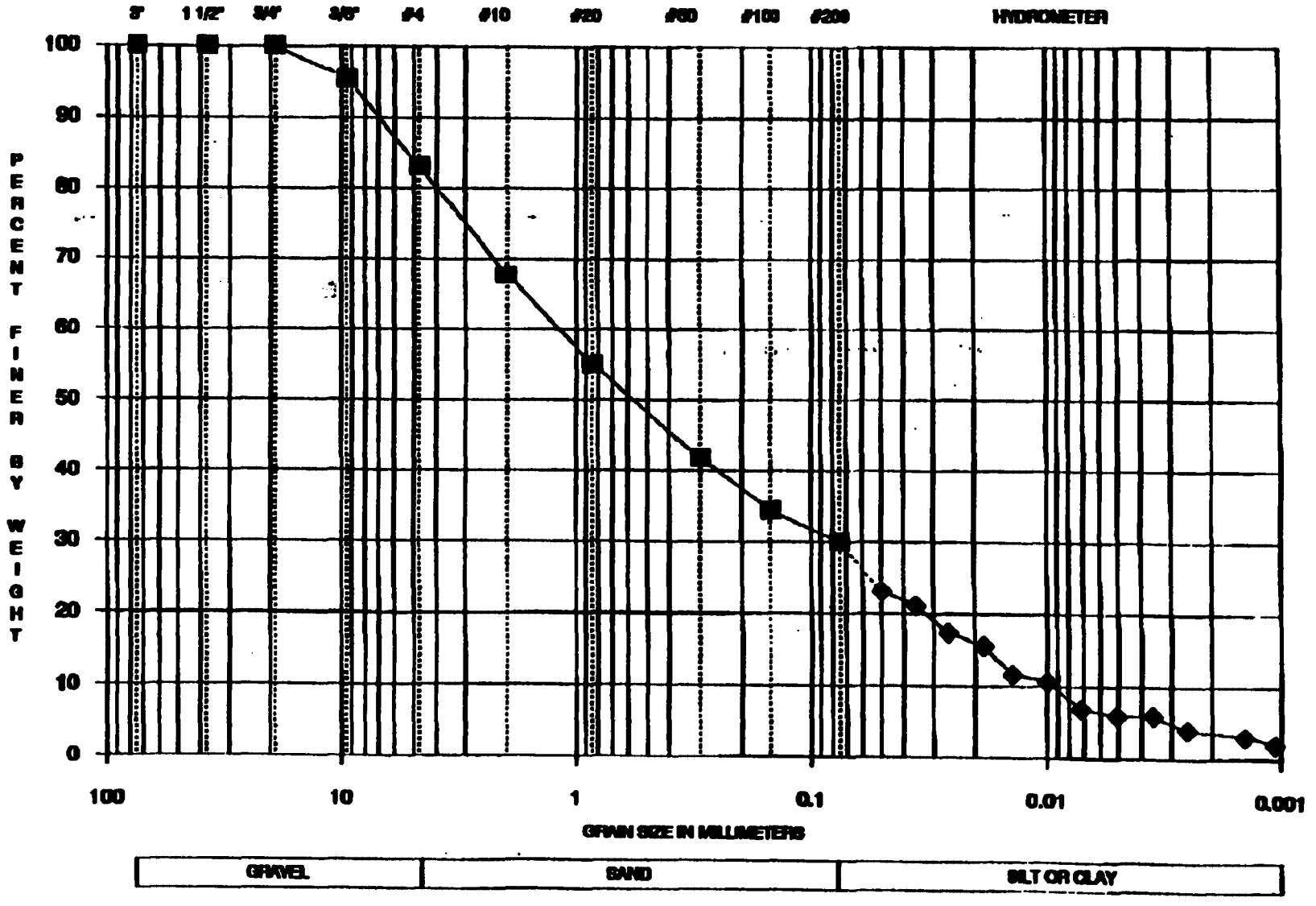


TABLE 4

SUMMARY OF TREATABILITY STUDY SAMPLE PHYSICAL CHARACTERIZATION

WESTON ENVIRONMENTAL TECHNOLOGY LABORATORY

GEOTECHNICAL TESTING DATA AND RESULTS

PROJECT	Moss American-Kerr McGee	PROJECT SAMPLE I.D.	Moss Amer-TS01	PROJECT ANALYST	SPM
JOB NUMBER	92090011	ETL SAMPLE NUMBER	001	QA/QC ANALYST	RWF
W. O. NUMBER	02667-007-001	DATE RECEIVED	9/21/92	DATE COMPLETED	10/16/92

PARTICLE SIZE DISTRIBUTION

U. S. Standard Sieve Size	Diameter mm	% Finer
3"	75.00	100.0
1 1/2"	37.50	100.0
3/4"	19.00	98.7
3/8"	9.500	84.2
#4	4.750	75.5
#10	2.000	65.8
#20	0.850	55.9
#50	0.300	44.7
#100	0.150	37.4
#200	0.075	32.9
HYDROMETER	0.0497	27.0
	0.0360	24.4
	0.0260	21.9
	0.0193	18.1
	0.0144	13.6
	0.0104	10.2
	0.0074	9.4
	0.0053	7.7
	0.0038	6.0
	0.0027	4.4
	0.0016	3.5
	0.0011	2.7

EFFECTIVE SIZES

% Finer	Diameter mm
60	1.328
30	NA
10	NA
Uniformity Coefficient	Gradation Coefficient
NA	NA

NATURAL MOISTURE CONTENT, % dry basis

85.6

SPECIFIC GRAVITY

2.24

SAMPLE DESCRIPTION

dark brown gravelly silty SAND with 24% gravel and 33% silt, also contained organics(bark)

Unified Soil Classification System (USCS) Group Symbol

SM

INDEX PROPERTIES
% moisture dry basis

Liquid Limit	Plastic Limit	Plasticity Index
non-plastic, non-cohesive		

BULK UNIT WEIGHT (disturbed, uncompacted)

wet g/cc	wet pcf	dry pcf
0.98	59.6	32.1

POROSITY

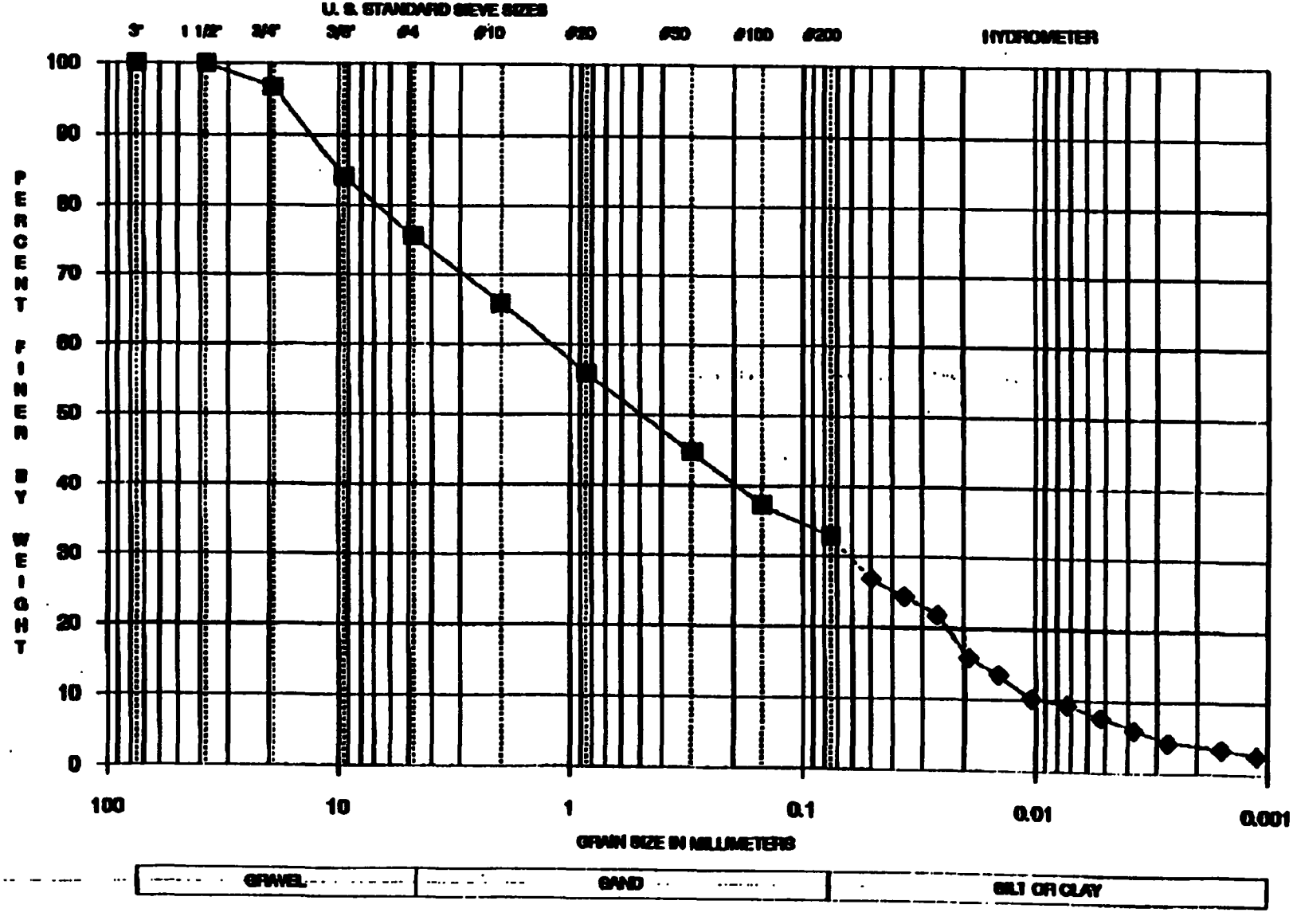
Void Ratio	Porosity,%	Saturation,%
3.359	77.1	57.2

NOTES

NA--NOT APPLICABLE

WESTON ENVIRONMENTAL TECHNOLOGY LABORATORY

PARTICLE-SIZE DISTRIBUTION CURVE FOR
MOSS AMERICAN-KERR MCGEE PROJECT SAMPLE MOSS AMER-TS01, ETL SAMPLE # 920000011-001



APPENDIX B
SHIPPING DOCUMENTATION

ss- ic: ite ata ty ple

WESTON Analytics Use Only

Custody Transfer Record/~~Lab Work Request~~

WESTON

Page ____ of ____

Client Moss-American Site (KMCC)
Est. Final Proj. Sampling Date
Work Order # 02687-007-001-0026
Project Contact/Phone # G. Deigan (708) 918-4114
AD Project Manager
QC Del TAT
Date Rec'd Date Due
Account #

Refrigerator #
#/Type Container: Liquid / Solid
Volume: Liquid / Solid
Preservatives

ANALYSES REQUESTED → ORGANIC: VOA, BNA, Pest/PCB, Herb; INORG: Metal, CN

MATRIX CODES:
S - Soil
SE - Sediment
SO - Solid
SL - Sludge
W - Water
O - Oil
A - Air
DS - Drum Solids
DL - Drum Liquids
L - EP/TCLP Leachate
WI - Wipe
X - Other
F - Fish

Lab ID	Client ID/Description	Matrix QC Chosen (✓) MS	MSD	Matrix	Date Collected	Time Collected	WESTON Analytics Use Only
C1135 10/27/92 11:12	Sample 1 (TS01)			S	9/18/92	1300	1-20 gallon steel drum
							Residuals From
							Batch Study

FIELD PERSONNEL: COMPLETE ONLY SHADED AREAS

Special Instructions:
Sample 1 for bioslurry treatability evaluation, per EPA-approved test plan.

DATE/REVISIONS: Additional Notes:
1.
2. Sample staged at Moss-American
3. site prior to shipment to IT
4. Corporation on 10/28/92.
5.
6.

WESTON Analytics Use Only

Samples were:
1) Shipped ___ or Hand Delivered ___
Airbill # _____
2) Ambient or Chilled
3) Received in Good Condition Y or N
4) Labels Indicate Properly Preserved Y or N
5) Received Within Holding Times Y or N

COC Tape was:
1) Present on Outer Package Y or N
2) Unbroken on Outer Package Y or N
3) Present on Sample Y or N
4) Unbroken on Sample Y or N
COC Record Present Upon Sample Rec't Y or N

Discrepancies Between Samples Labels and COC Record? Y or N
NOTES:

Relinquished by	Received by	Date	Time
G Deigan		10/28/92	1500
	[illegible]	11/2/92	10:30

Relinquished by	Received by	Date	Time
[illegible]		1/8/93	1600

RFW 21-21-001/A-7/91 ____ L372 ____ L373 ____ L375 ____ L377 ____ L378 Ref# _____ Cooler# _____ 381-596a

SENDER'S COPY

Sender's Federal Express Account Number	
From (Your Name) Please Print: Terry J. Smith	Your Phone Number (Very Important): (615) ... 911
Company: I T CORP	Department/Floor No.
Street Address: 312 DIRECTORS DRIVE	
City: KNOXVILLE	State: TN ZIP Required: 37923
To (Recipient's Name) Please Print: Barry ...	Recipient's Phone Number (Very Important): (...) ...
Company: ...	Department/Floor No.
Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip® Codes): 42 ... Dr. ...	
City: ...	State: TN ZIP Required: ...

YOUR INTERNAL BILLING REFERENCE INFORMATION (First 24 characters will appear on invoice.)

IF HOLD FOR PICK-UP, Print FEDEX Address Here (Not available at all locations)
Street Address / City / State / ZIP Required

PAYMENT 1 ☐ Bill Sender 2 ☑ Bill Recipient's FedEx Acct. No. 3 ☐ Bill 3rd Party FedEx Acct. No. 4 ☐ Bill Credit Card 5 ☐ Cash/Check Acct./Credit Card No.

SERVICES (Check only one box)

- Priority Overnight Service (Delivery by next business morning†) 11 ☑
- Standard Overnight Service (Delivery by next business afternoon†) 51 ☐
- Economy Two-Day Service (formerly Standard Air) (Delivery by second business day†) 30 ☐
- Heavyweight Service (for Extra Large or any package over 150 lbs.) 70 ☐ 80 ☐

†Delivery commitment may be later in some areas. *Call for delivery schedule.

INSTRUCTIONS (Check only one box)

- Dangerous Goods as per attached Shipper's Declaration ☑
- Dangerous Goods Shipper's Declaration not required ☐
- Cargo Aircraft only ☐

DELIVERY AND SPECIAL HANDLING (Check services required)

1 ☐ HOLD FOR PICK-UP (Fill in Box H)
2 ☑ DELIVER WEEKDAY
3 ☐ DELIVER SATURDAY (Extra charge) (Not available to all locations)
4 ☒ DANGEROUS GOODS (Extra charge)
6 ☐ DRY ICE
7 ☐ OTHER SPECIAL SERVICE
11 ☐ DESCRIPTION
12 ☐ HOLIDAY DELIVERY (If offered) (Extra charge)

Packages: 1 Weight: 110 Total: 110

SERVICE CONDITIONS, DECLARED VALUE AND LIMIT OF LIABILITY

Use of this airbill constitutes your agreement to the service conditions in our current Service Guide, available upon request. See back of sender's copy of this airbill for information.

We will not be responsible for any claim in excess of $100 per package, whether the result of loss, damage, delay, non-delivery, misdelivery, or misinformation, unless you declare a higher value, pay an additional charge, and document your actual loss for a timely claim. ...

In the event of untimely delivery, Federal Express will at your request and with some limitations, refund all transportation charges paid. See Service Guide for further information.

SIGNATURE RELEASE UNAVAILABLE

FedEx Emp. No. | Date/Time

Federal Express Use: Base Charges | Declared Value Charge | Other 1 | Other 2 | Total Charges

REVISION DATE 8/90 PART #... FORMAT #043 MBFAN 9/90 043 © 1990 F.E.C. PRINTED IN U.S.A.

9641433745 AIRBILL NUMBER

SHIPPER'S CERTIFICATION FOR RESTRICTED ARTICLES/DANGEROUS GOODS (TYPE OR PRINT)

CHECK ONE ☐ 49 CFR ☑ IATA/ICAO

Environmental Hazardous Substances Solid N.O.S. (...) — 9 — ... — 1 Steel Drum ... 55 Kg — 9.11 III

ADDITIONAL HANDLING INFORMATION

TRANSPORT DETAILS	THIS SHIPMENT IS WITHIN THE LIMITATIONS PRESCRIBED FOR ▶	PASSENGER AIRCRAFT	~~CARGO AIRCRAFT ONLY~~	(DELETE-NONAPPLICABLE)
AIRPORT OF DEPARTURE	AIRPORT OF DESTINATION	SHIPMENT TYPE ▶	NON-RADIOACTIVE	~~RADIOACTIVE~~	(DELETE-NONAPPLICABLE)

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS OR TREATMENT.

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY PROPER SHIPPING NAME AND ARE CLASSIFIED, PACKED, MARKED, AND LABELED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT BY AIR ACCORDING TO THE APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.

NAME AND TITLE OF SHIPPER	PLACE AND DATE
... Smith ...	Knoxville, TN ...
EMERGENCY TELEPHONE NUMBER	SIGNATURE OF SHIPPER
... 690-911	[signature]

SEE WARNING ON BACK

7043563365

X IATA/ICAO (TYPE OR PRINT)

PROPER SHIPPING NAME	CLASS OR DIVISION	UN OR ID NO.	SUBSIDIARY RISK	QUANTITY AND TYPE OF PACKING	PACKING INST	AUTHORIZATION
Environmental Hazardous Substances Solid N.O.S. (R.Q. CRESOTE)	9	UN3077		1 Steel Drum X 79kg	III	A86

ADDITIONAL HANDLING INFORMATION

TRANSPORT DETAILS	THIS SHIPMENT IS WITHIN THE LIMITATIONS PRESCRIBED FOR	PASSENGER AIRCRAFT	CARGO AIRCRAFT ONLY	(DELETE NONAPPLICABLE)
AIRPORT OF DEPARTURE	AIRPORT OF DESTINATION / SHIPMENT TYPE	NON RADIOACTIVE	RADIOACTIVE	(DELETE NONAPPLICABLE)

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH MEDICAL DIAGNOSIS OR TREATMENT.

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY PROPER SHIPPING NAME AND ARE CLASSIFIED, PACKED, MARKED, AND LABELED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT BY AIR ACCORDING TO THE APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.

NAME AND TITLE OF SHIPPER: Dave Cullom Eq. Tech.

PLACE AND DATE: Park City 10/3/92

EMERGENCY TELEPHONE NUMBER: 800-535-5053

SIGNATURE OF SHIPPER: David M. Cullom

SEE WARNING ON BACK

WESTON Analytics Use Only

Custody Transfer Record/Lab Work Request

Page

Date Rec'd

Account #

ORGANIC

INORG

ANALYSES REQUESTED

WESTON Analytics Use Only

FIELD PERSONNEL: COMPLETE ONLY SHADED AREAS

Special Instructions:

Relinquished by	Received by	Date	Time	Relinquished by	Received by	Date	Time
[illegible]	C. [illegible]	[illegible]	[illegible]	[illegible]		[illegible]	
		[illegible]					

Discrepancies Between Samples Labels and COC Record? Y or N

NOTES:

3) Received in Good Condition Y or N

4) Labels Indicate Properly Preserved Y or N

5) Received Within Holding Times

RFW 21-21-001/A-7/91

L372 L370 L377 L370

WESTON Analytics Use Only

Custody Transfer Record/Lab Work Request

WESTON

Page

Date Rec'd

Account #

ANALYSIS

ORGANICS

INORGS

WESTON Analytics Use Only

FIELD PERSONNEL: DO NOT ONLY CHARGE AREAS

Special Instructions

Relinquished by	Received by	Date	Time	Relinquished by	Received by	Date	Time

Discrepancies Between Samples Labels and COC Records? Y or N

NOTES:

WESTON Analytics Use Only

1) Broken? ___ If so, how many?

Airbill #

2) Ambient or Chilled?

3) Received in Good Condition Y or N

4) Labels Indicate Properly Preserved Y or N

5) Received Within Holding Time? Y or N

COC

6) Proper

7) Labels

8) Used

RFW 21-21-001/A-7/91

L373 L378 L379 L375 L377 L376 Rev1

WESTON Analytics Use Only

Custody Transfer Record/Lab Work Request

WESTON

Page

Client

Est. Final Proj. Samp. Date

Work Order #

Project Contact/Phone #

AD Project Manager

QC

Date Rec'd

Account #

Refrigerator #

#/Type Container

Volume

Preservatives

ANALYSES REQUESTED

ORGANIC				INORG	
VOA	BNA	Pest/PCB	Herb	Metal	CN

WESTON Analytics Use Only

FIELD PERSONNEL: COMPLETE ONLY SHADED AREAS

Special Instructions:

WESTON Analytics Use Only

Samples were:
1) Shipped ___ or Hand Delivered ___
Airbill # ___
2) Ambient or Chilled
3) Received in Good Condition Y or N
4) Labels Indicate Properly Preserved Y or N
5) Received Within Holding Times Y or N

COC Tape was:
1) Present on Outer Package Y or N
2) Unbroken on Outer Package Y or N
3) Present on Sample Y or N
4) Unbroken on Sample Y or N
COC Record Present Upon Sample Rec'pt Y or N

Relinquished by	Received by	Date	Time	Relinquished by	Received by	Date	Time

Discrepancies Between Samples Labels and COC Record? Y or N
NOTES:

RFW 21-21-001/A-7/91 ___ L372 ___ L375 ___ L376 ___ L377 ___ L370 Ref# ___ Contr# ___

[redacted] [redacted]

WESTON Analytics Use Only

Custody Transfer Record/Lab Work Request

WESTON

Page ____ of ____

Refrig. #

Container Type

Volume

Preservative

ANALYSES REQUESTED

ORGANIC

INORG

Date Rec'd ____ Date Due ____

WESTON Analytics Use Only

ID

FIELD PERSONNEL: COMPLETE ONLY SHADED AREAS

Special Instructions:

WESTON Analytics Use Only

COC Tape was:

1) Present on Outer Package Y or N

2) Unbroken on Outer Package Y or N

3) Present on Sample Y or N

4) Unbroken on Sample Y or N

1) Shipped

2) Ambient or Chilled

3) Received in Good Condition Y or N

4) Labels Indicate Properly Preserved Y or N

5) Received Within Holding Times Y or N

COC Record Present Upon Sample Rec'd Y or N

Relinquished by	Received by	Date	Time	Relinquished by	Received by	Date	Time

Discrepancies Between Samples Labels and COC Record Y or N

NOTES:

FC-11-91-031A-7/91 ____ L372 ____ L373 ____ L376 ____ L377 ____ L378 ____ Ref# ____ Control# ____

FEDERAL EXPRESS

QUESTIONS? CALL 800-238-5355 TOLL FREE.

AIRBILL PACKAGE TRACKING NUMBER 2865531981

1135# 2865531981

Date 1/14/93

RECIPIENT'S COPY

From (Your Name) Please Print: G. DEIGAN
Your Phone Number (Very Important): (708-918-4009
Company: ROY F. WESTON INC
Department/Floor No.:
Street Address: THREE HAWTHORN PKWY STE 400
City: VERNON HILLS
State: IL
ZIP Required: 6 0 0 6 1

To (Recipient's Name) Please Print: KANDI BROWN
Recipient's Phone Number (Very Important): (615) 690-3211
Company: IT CORPORATION BIOTECH APPLIC. CENTER
Department/Floor No.:
Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes.): 9041 EXECUTIVE PARK DRIVE (SUITE 309)
City: KNOXVILLE
State: TN
ZIP Required: 37923

YOUR INTERNAL BILLING REFERENCE INFORMATION (First 24 characters will appear on invoice.): 000025026879000010026

IF HOLD FOR PICK-UP, Print FEDEX Address Here (Not available at all locations)
Street Address:
City:
State:
ZIP Required:

3 PAYMENT 1 [X] Sender 2 [ ] Bill Recipient's FedEx Acct. No. 3 [ ] Bill 3rd Party FedEx Acct. No. 4 [ ] Bill Credit Card
5 [ ] Cash/Check

4 SERVICES (Check only one box)

Priority Overnight	Standard Overnight
11 [ ]	51 [ ]
Economy Two-Day	Government Overnight
30 [ ]	41 [ ]

Freight Service
70 [ ] OVERNIGHT FREIGHT **
80 [ ] TWO-DAY FREIGHT **
†Delivery commitment may be later in some areas.
**Declared Value Limit $100. **Call for delivery schedule.

INSTRUCTIONS (Mark appropriate boxes)
- Dangerous Goods as per attached Shipper's Declaration [X]
- Dangerous Goods Shipper's Declaration not required [ ]
- Cargo Aircraft only [ ]

DELIVERY AND SPECIAL HANDLING (Check services required)
1 [ ] HOLD FOR PICK-UP (Fill in Box H)
2 [X] DELIVER WEEKDAY
3 [ ] DELIVER SATURDAY (Extra charge) (Not available to all locations)
4 [X] DANGEROUS GOODS (Extra charge)
6 [ ] DRY ICE .. Lbs.
- Dangerous Goods Shipper's Declaration not required
- Dry Ice, 9, UN 1845, ... kg
7 [ ] OTHER SPECIAL SERVICE
11 [ ]
12 [ ] HOLIDAY DELIVERY (If offered) (Extra charge)

PACKAGES | WEIGHT in Pounds only
Total | Total

DIM SHIPMENT (Chargeable Weight) [ ] ____ lbs.

Received At
1 [ ] Regular Stop 3 [ ] Drop Box 4 [ ] B.S.C. 2 [ ] On-Call Stop 5 [ ] Station
FedEx Emp. No.
Date/Time

Emp. No. | Date
[ ] Cash Received
[ ] Return Shipment
[ ] Third Party [ ] Chg. To Dal [ ] Chg. To Hold
Street Address
City | State | Zip
Received By: X
Date/Time Received | FedEx Employee Number

SIGNATURE RELEASE UNAVAILABLE

Federal Express Use
Base Charges
Declared Value Charge
Other 1
Other 2
Total Charges

REVISION DATE 2/91 PART # 137211 FORMAT #069
069
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2865531981 AIRBILL NUMBER

SHIPPER'S CERTIFICATION FOR RESTRICTED ARTICLES/DANGEROUS GOODS
CHECK ONE ➡ [ ] 49 CFR [X] IATA/ICAO (TYPE OR PRINT)

DANGEROUS GOODS IDENTIFICATION: PROPER SHIPPING NAME	CLASS OR DIVISION	UN OR I.D. NO.	SUBSIDIARY RISK	QUANTITY AND TYPE OF PACKING	PACKING INST.	AUTHORIZATION
ENVIRONMENTAL HAZARDOUS SUBSTANCES SOLIDS N.O.S. (R.Q.) (Creosote)	9	UN 3077		(1) STEEL DRUM + 75 KG	911 III	

ADDITIONAL HANDLING INFORMATION

TRANSPORT DETAILS	THIS SHIPMENT IS WITHIN THE LIMITATIONS PRESCRIBED FOR ▶	PASSENGER AIRCRAFT	CARGO [redacted]	(DELETE-NONAPPLICABLE)
AIRPORT OF DEPARTURE	AIRPORT OF DESTINATION / SHIPMENT TYPE ▶	NON-RADIOACTIVE	[redacted]	(DELETE-NONAPPLICABLE)

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS OR TREATMENT.

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NAME AND TITLE OF SHIPPER: Project Manager
PLACE AND DATE: Vernon Hills, Illinois 1/14/93
EMERGENCY TELEPHONE NUMBER: 800-255-3924
SIGNATURE OF SHIPPER:

SEE WARNING ON BACK

FEDERAL EXPRESS — QUESTIONS? CALL 800 238-5355 TOLL FREE.

AIRBILL PACKAGE TRACKING NUMBER 2865531955

1135M 2865531955

Date 1/14/93

RECIPIENT'S COPY

From (Your Name) Please Print: G. DEIGAN
Your Phone Number (Very Important): (708) 918-4000
Company: ROY F. WESTON INC
Department/Floor No.:
Street Address: THREE HAWTHORN PKWY STE 400
City: VERNON HILLS
State: IL
ZIP Required: 60061

To (Recipient's Name) Please Print: KANDI BROWN
Recipient's Phone Number (Very Important): (615) 690-3211
Company: IT CORPORATION BIOTECH APPLIC. CENTER
Department/Floor No.:
Exact Street Address (No Local Office or P.O. Box): 9041 EXECUTIVE PARK DRIVE (SUITE 309)
City: KNOXVILLE
State: TN
ZIP Required: 37923

YOUR INTERNAL BILLING REFERENCE INFORMATION (First 24 characters will appear on invoice.)
00002502687007001002G

IF HOLD FOR PICK-UP, Print FEDEX Address Here (Not available at all locations)
Street Address:
City:
State:
ZIP Required:

PAYMENT 1 [X] Bill Sender 2 [ ] Bill Recipient's FedEx Acct. No. 3 [ ] Bill 3rd Party FedEx Acct. No. 4 [ ] Bill Credit Card 5 [ ] Cash/Check

4 SERVICES (Check only one box)

Priority Overnight (Delivery by next business morning)	Standard Overnight (Delivery by next business afternoon)
11 [ ]	51 [ ]
Economy Two-Day (Delivery by second business day)	**Government Overnight** (Delivered by authorized users only)
30 [ ]	41 [ ]

Freight Service (for Extra Large or any package over 150 lbs.)
70 [ ] OVERNIGHT FREIGHT ** (Delivery commitment request)
80 [X] TWO-DAY FREIGHT **
†Delivery commitment may be later in some areas. *Declared Value Limit $500. **Call for delivery schedule.

INSTRUCTIONS (Mark appropriate boxes)
- Dangerous Goods as per attached Shipper's Declaration [X]
- Dangerous Goods Shipper's Declaration not required [ ]
- Cargo Aircraft only [ ]

DELIVERY AND SPECIAL HANDLING (Check services required)
1 [ ] HOLD FOR PICK-UP (Fill in Box H)
2 [X] DELIVER WEEKDAY
3 [ ] DELIVER SATURDAY (Extra charge) (Not available to all locations)
4 [X] DANGEROUS GOODS (Extra charge)
6 [ ] DRY ICE Kgs
- Dangerous Goods Shipper's Declaration not required
- Dry Ice, 9, UN 1845, x kg
7 [ ] OTHER SPECIAL SERVICE
11 [ ]
12 [ ] HOLIDAY DELIVERY (If offered) (Extra charge)

PACKAGES: Total 1 — WEIGHT in Pounds Only: Total 117

DIM SHIPMENT (Chargeable Weight) [ ] ____ lbs.

Received At: 1 [ ] Regular Stop 2 [ ] On-Call Stop 3 [ ] Drop Box 4 [ ] B.S.C. 5 [ ] Station

FedEx Emp. No. Date/Time

Emp. No. Date

[ ] Cash Received [ ] Return Shipment [ ] Third Party [ ] Chg To Del [ ] Chg To Hold

Street Address City State Zip

Received By: X

Date/Time Received FedEx Employee Number

SIGNATURE RELEASE UNAVAILABLE

Federal Express Use
Base Charges
Declared Value Charge
Other 1
Other 2
Total Charges

REVISION DATE 2/91 PART # 137211 FORMAT 4069 MBFAN 4/91
069
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2865531955 AIRBILL NUMBER

SHIPPER'S CERTIFICATION FOR RESTRICTED ARTICLES/DANGEROUS GOODS
CHECK ONE ➡ [ ] 49 CFR [X] IATA/ICAO (TYPE OR PRINT)

DANGEROUS GOODS IDENTIFICATION: PROPER SHIPPING NAME	CLASS	ID NO.	SUBS-DIARY RISK	QUANTITY AND TYPE OF PACKING	PACKING INST	AUTHOR-IZATION
ENVIRONMENTAL HAZARDOUS SUBSTANCES SOLIDS N.O.S.(R.Q.) ((REOSOTE)	9	UN 3077		(1) STEEL DRUM + 75 KG	911 III	

ADDITIONAL HANDLING INFORMATION

TRANSPORT DETAILS	THIS SHIPMENT IS WITHIN THE LIMITATIONS PRESCRIBED FOR ▶		PASSENGER AIRCRAFT [redacted]	(DELETE-NONAPPLICABLE)
AIRPORT OF DEPARTURE	AIRPORT OF DESTINATION	SHIPMENT TYPE ▶	NON-RADIOACTIVE [redacted]	(DELETE-NONAPPLICABLE)

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS OR TREATMENT.

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NAME AND TITLE OF SHIPPER: GARY J. DEIGAN Project Mgr. [illegible]
PLACE AND DATE: Vernon Hills IL - 1/14/93
EMERGENCY TELEPHONE NUMBER: [redacted] 800 255-3924
SIGNATURE OF SHIPPER:

SEE WARNING ON BACK

FEDERAL EXPRESS

QUESTIONS? CALL [illegible] TOLL FREE.

AIRBILL PACKAGE TRACKING NUMBER 2865531966

1135 2865531966

Date 1/14/93

RECIPIENT'S COPY

From (Your Name) Please Print: G. DEIGAN
Your Phone Number (Very Important): (708-918-4000
Company: ROY F. WESTON INC
Department/Floor No.:
Street Address: THREE HAWTHORN PKWY STE 400
City: VERNON HILLS
State: IL
ZIP Required: 6 0 0 6 1

2 To (Recipient's Name) Please Print: KANDI BROWN
Recipient's Phone Number (Very Important): (615) 690-3211
Company: IT CORPORATION BIOTECH APPLIC. CENTER
Department/Floor:
Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes.): 9041 EXECUTIVE PARK DRIVE ~~(SUITE 309)~~
City: KNOXVILLE
State: TN
ZIP Required: 38923

YOUR INTERNAL BILLING REFERENCE INFORMATION (First 24 characters will appear on invoice.)
00002502687007001026

H IF HOLD FOR PICK-UP, Print FEDEX Address Here (Not available at all locations)
Street Address:
City:
State:
ZIP Required:

3 PAYMENT 1 Bill Sender 2 Bill Recipient's FedEx Acct. No. 3 Bill 3rd Party FedEx Acct. No. 4 Bill Credit Card
5 Check

4 SERVICES (Check only one box)

Priority Overnight (Delivery by next business morning) 11	Standard Overnight (Delivery by next business afternoon) 51
Economy Two-Day (Delivery by second business day) 30	Government Overnight (Available to selected users only) 41

Freight Service (for Extra Large or any shipments over 150 lbs.)
70 OVERNIGHT FREIGHT ** (Customer assistance required.) †Delivery commitment may be later in some areas.
80 2ND-DAY FREIGHT ** **Call for delivery schedule.

INSTRUCTIONS (Mark appropriate boxes)
- Dangerous Goods as per attached Shipper's Declaration: X
- Dangerous Goods Shipper's Declaration not required:
- Cargo Aircraft only:

DELIVERY AND SPECIAL HANDLING (Check services required)
1 HOLD FOR PICK-UP (Fill in Box H)
2 X DELIVER WEEKDAY
3 DELIVER SATURDAY (Extra charge) (Not available to all locations)
4 X DANGEROUS GOODS (Extra charge)
6 DRY ICE Kgs.
- Dangerous Goods Shipper's Declaration not required
- Dry Ice, 9, UN 1845 kg
7 OTHER SPECIAL SERVICE
11
12 HOLIDAY DELIVERY (Extra charge)

PACKAGES: Total 1
WEIGHT (In Pounds Only): Total 175
DIM SHIPMENT (Chargeable Weight): lbs.
Received At: 1 Regular Stop; 2 On-Call Stop; 3 Drop Box; 4 BSC; 5 Station
FedEx Emp. No.
Date/Time

Emp. No. Date
Cash Received
Return Shipment
Third Party Chg. To Del Chg. To Hold
Street Address
City State Zip
Received By: X
Date/Time Received FedEx Employee Number

SIGNATURE RELEASE UNAVAILABLE

Federal Express Use
Base Charges
Declared Value Charge
Other 1
Other 2
Total Charges

REVISION DATE 2/91 PART # 137211 FORMAT #069 MBF 4/
069
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2865531966 AIRBILL NUMBER

SHIPPER'S CERTIFICATION FOR RESTRICTED ARTICLES/DANGEROUS GOODS
CHECK ONE ➡ ☐ 49 CFR ☑ IATA/ICAO (TYPE OR PRINT)

DANGEROUS GOODS IDENTIFICATION: PROPER SHIPPING NAME	CLASS	ID NO.	PACKING GROUP	QUANTITY AND TYPE OF PACKING	PACKING INST.	AUTHORIZATION
ENVIRONMENTAL HAZARDOUS SUBSTANCES SOLIDS N.O.S. (R.Q.) (CREOSOTE)	9	UN 3077		(1) STEEL DRUM + 75 KG	911 III	

ADDITIONAL HANDLING INFORMATION

TRANSPORT DETAILS	THIS SHIPMENT IS WITHIN THE LIMITATIONS PRESCRIBED FOR ➡	PASSENGER AIRCRAFT	[illegible]	(DELETE-NONAPPLICABLE)
AIRPORT OF DEPARTURE	AIRPORT OF DESTINATION / SHIPMENT TYPE ➡	NON-RADIOACTIVE	[illegible]	(DELETE-NONAPPLICABLE)

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS OR TREATMENT.

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NAME AND TITLE OF SHIPPER: Gary J. DEIGAN, Project Manager
PLACE AND DATE: Dry City Illinois 1/14/93
EMERGENCY TELEPHONE NUMBER: [illegible] 800-755-3924
SIGNATURE OF SHIPPER: Gary Deigan
SEE WARNING ON BACK

QUESTIONS? CALL 1-800-238-5355 TOLL FREE

AIRBILL PACKAGE TRACKING NUMBER 2865531992

1135 2865531992

Date 4/4/93

RECIPIENT'S COPY

From (Your Name) Please Print	Your Phone Number (Very Important)	To (Recipient's Name) Please Print	Recipient's Phone Number (Very Important)
G. DEIGAN	(708-918-4000	KANDI [illegible]	(615) 689-3211
Company	Department/Floor No.	Company	Department/Floor No.
ROY F. WESTON INC		IT CORPORATION BIOTECH APPLIC. CENTER	
Street Address		Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes.)	
THREE HAWTHORN PKWY STE 400		9041 EXECUTIVE PARK DRIVE (SUITE 309)	
City / State / ZIP Required		City / State / ZIP Required	
VERNON HILLS IL 60061		KNOXVILLE TN 37923	

YOUR INTERNAL BILLING REFERENCE INFORMATION (First 24 characters will appear on invoice.)

00002502687007001002 6

IF HOLD FOR PICK-UP, Print FEDEX Address Here (Not available at all locations)

Street Address

City / State / ZIP Required

3 PAYMENT 1 [X] Bill Sender 2 [ ] Bill Recipient's FedEx Acct. No. 3 [ ] Bill 3rd Party FedEx Acct. No. 4 [ ] Bill Credit Card 5 [ ] Cash/Check

4 **SERVICES** (Check only one box)

Priority Overnight	Standard Overnight
11 [ ]	51 [ ]
Economy Two-Day	Government Overnight
30 [ ]	41 [ ]

Freight Service

70 [ ] OVERNIGHT FREIGHT ** 80 [X] TWO-DAY FREIGHT **

† Delivery commitment may be later in some areas. ** Call for delivery schedule.

DELIVERY AND SPECIAL HANDLING (Check services required)

1 [ ] HOLD FOR PICK-UP (Fill in Box H)
2 [ ] DELIVER WEEKDAY
3 [ ] DELIVER SATURDAY (Extra charge)
4 [X] DANGEROUS GOODS (Extra charge)
6 [ ] DRY ICE ... kg
• Dangerous Goods Shipper's Declaration not required
• Dry Ice, 9, UN 1845 ... x ... kg
7 [X] OTHER SPECIAL SERVICE
11 [ ]
12 [ ] HOLIDAY DELIVERY (Extra charge)

PACKAGES	WEIGHT In Pounds Only
Total	Total 1 175

DIM SHIPMENT (Chargeable Weight) [ ] ... lbs.

Received At: 1 [ ] Regular Stop 2 [ ] On-Call Stop 3 [ ] Drop Box 4 [ ] B.S.C 5 [ ] Station

FedEx Emp. No. Date/Time

Emp. No. Date

[ ] Cash Received [ ] Return Shipment [ ] Third Party [ ] Chg. To Del. [ ] Chg. To Hold

Street Address

City State Zip

Received By: X

Date/Time Received FedEx Employee Number

SIGNATURE RELEASE UNAVAILABLE

Federal Express Use

Base Charges

Declared Value Charge

Other 1

Other 2

Total Charges

REVISION DATE 2/91 PART # 137211 FORMAT #088 MBFAN 4/91

069

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INSTRUCTIONS (Mark appropriate boxes)

- Dangerous Goods as per attached Shipper's Declaration [X]
- Dangerous Goods Shipper's Declaration not required [ ]
- Cargo Aircraft only [ ]

2865531992 AIRBILL NUMBER

SHIPPER'S CERTIFICATION FOR RESTRICTED ARTICLES/DANGEROUS GOODS

CHECK ONE ➡ [ ] 49 CFR [X] IATA/ICAO (TYPE OR PRINT)

DANGEROUS GOODS IDENTIFICATION: PROPER SHIPPING NAME	CLASS	UN/ID NO.	PACKING GROUP	QUANTITY AND TYPE OF PACKING	PACKING INST.	AUTHORIZATION
ENVIRONMENTAL HAZARDOUS SUBSTANCES SOLIDS N.O.S. N.Q. (CREOSOTE)	9	UN 3077		(1) STEEL DRUM + 75 KG	911 III	

ADDITIONAL HANDLING INFORMATION

TRANSPORT DETAILS	THIS SHIPMENT IS WITHIN THE LIMITATIONS PRESCRIBED FOR ▶	PASSENGER AIRCRAFT	CARGO AIRCRAFT ONLY	(DELETE-NONAPPLICABLE)
AIRPORT OF DEPARTURE	AIRPORT OF DESTINATION / SHIPMENT TYPE ▶	NON-RADIOACTIVE	[illegible]	(DELETE-NONAPPLICABLE)

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NAME AND TITLE OF SHIPPER	PLACE AND DATE
JAMES J. DEIGAN, Project Manager	Park City Illinois 4/4/93
EMERGENCY TELEPHONE NUMBER	SIGNATURE OF SHIPPER
[illegible] 800-255-3924	[signature]

SEE WARNING ON BACK

APPENDIX C
EIMCO PROCESS EQUIPMENT
SOIL EVALUATION REPORT

EIMCO Process Equipment Company
A Baker Hughes company

November 19, 1992

Ms. Kandi L. Brown
IT Corporation
312 Director's Drive
Knoxville, Tennessee 37923

Re: Slurry Evaluation

Dear Ms. Brown:

Per your request, EIMCO's T&D group has performed an evaluation of the soil sample from the Moss American site in order to recommend a slurry concentration (weight percent solids) for a given particle size cut for optimal operation of the Biolift® Reactor. The procedure for the evaluation is attached (this protocol was also forwarded to you prior to the test). In addition to the usual evaluation, a viscosity curve was generated for the respective concentrations.

In order to perform slurry phase bioremediation of contaminated soils, a solids classification and pretreatment system is usually employed. This allows you to minimize the volume of solids to be treated in the slurry phase. Frequently, this pretreatment consists of a series of wet screening devices combined with attrition and/or flotation steps. The screening and attrition steps allow the washing and removal of the larger (usually harder) particles while at the same time concentrating the contaminants in the aqueous phase with the fines. Attrition provides the energy to break the "clumps and clods". Flotation can be utilized to remove any light organic material like wood chips and plastic and/or to remove any free oil. If these particles are allowed to remain in the system they can adversely affect the clean-up results, besides, they are more amenable to incineration than to biodegradation.

Based on the particle size distribution (attached) we eliminate approximately 40% of the mass at the +10 mesh (2 mm) cut. Material passing 10 mesh would be the largest we would want to put into the reactor. Based on the large percentage of -200 mesh (75 μm) material (38%), it was decided that the reactor could treat up to 10 mesh material based on the sample received. Therefore, a slurry evaluation of -10 mesh material was performed. Additionally, after reviewing the size distribution, it was decided that a -28 mesh (0.589 mm) slurry should be evaluated. By eliminating all material 28 mesh and larger, the volume of material to be treated would be reduced to 50% of the original. Plus 28 mesh material would be handled ideally by soil washing as described above.

It may be advantageous to analyze the contaminant concentration of the various size fractions to determine the target cut size. Additionally, evaluating whether the contaminants are more concentrated in the organic material (primarily wood chips) or in the clayey soil fraction will assist you in determining your treatment scheme.

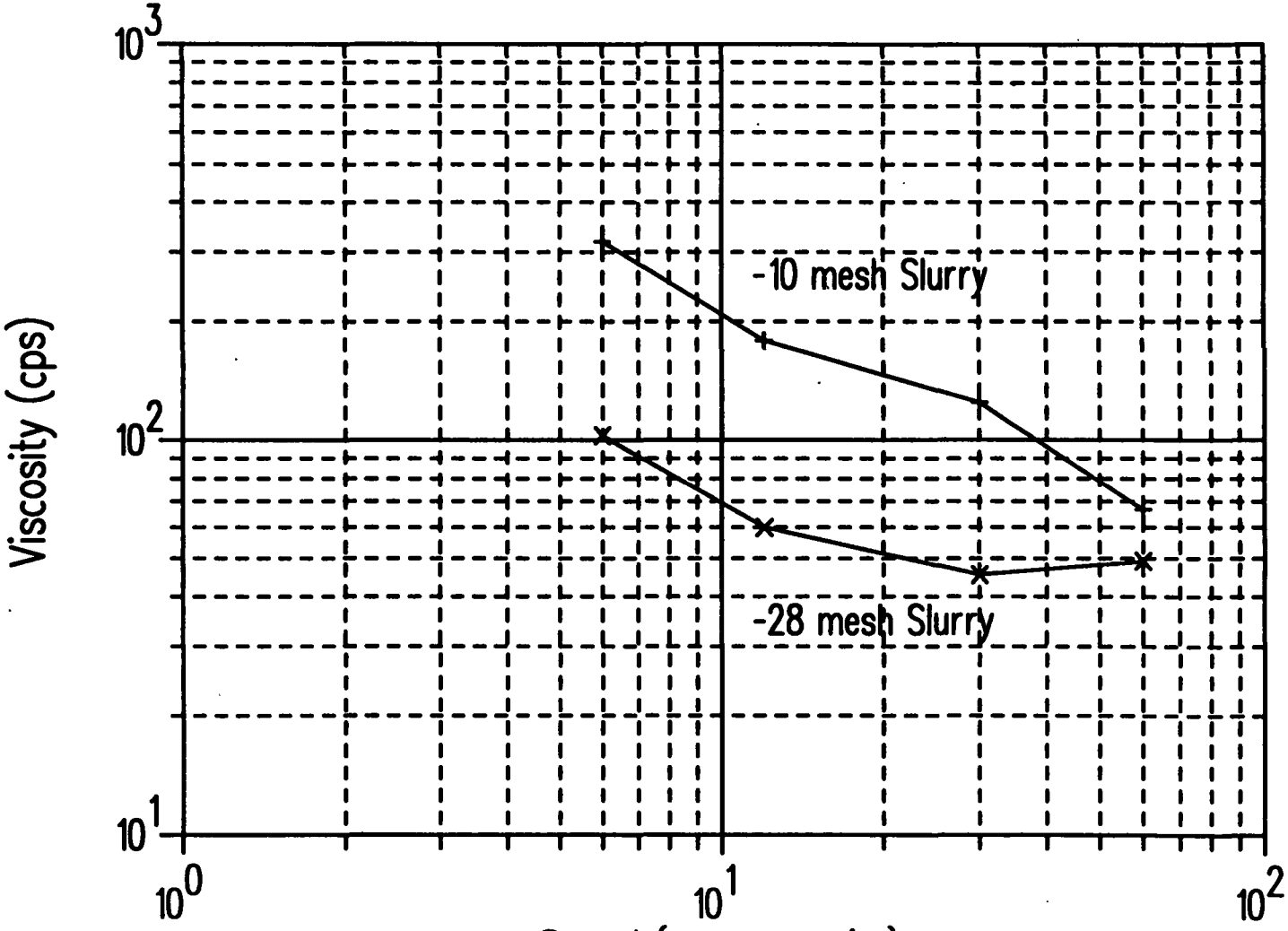
The two slurry evaluations conducted indicate that the lower limit for solids concentration for the -10 mesh material should be 45% wt. If the cut is to be 28 mesh and smaller the slurry can be 35% wt.

SIEVE ANALYSIS

Media Description: American Moss Site
Media Source: IT Corporation
Date: Nov. 16, 19 **Investigator:** D. Hanify

Sieve Number	Weight Retained	Percent Retained	Percent Smaller than Stated Size
4	169.23	29.50	70.5
10	59.72	10.41	60.1
28	43.24	7.54	52.6
48	33.32	5.81	46.7
100	24.61	4.29	42.5
200	26.5	4.62	37.8
200–	217.1	37.84	
	Sum =	100.00	

IT CORPORATION - MOSS AMERICAN SITE



VISCOSITY vs. SPINDLE SPEED

Soil Slurry Evaluation for use in the EIMCO Biolift® Reactor

Description — The following outlines a general procedure for the evaluation of soil slurries that are under consideration for biotreatment in the EIMCO Biolift Reactor. The purpose of this evaluation is to determine the largest particle size fraction to be suspended with a corresponding lower limit in slurry concentration.

Procedure

1. Wet screen approximately one kilogram of soil sample to pass a 200 mesh (75 µm) screen; this material comprises the fine fraction.
2. Thicken that "watery" slurry.
3. Decant the supernatant water from the fine slurry.
4. Dry the +200 mesh sample, this material is the coarse fraction. Vibrate the material on the shaker to make sure the fines have been removed. Add the -200 mesh material collected to the fine fraction.
5. Measure the solids concentration of the fine fraction.
6. Dry screen the +200 mesh portion to produce a sieve curve.
7. From the solids concentration of the fine fraction determine the mass of dry solids in the slurry.
8. Using available data relating contaminant concentration versus particle size, decide on the largest particle size fraction to be suspended.
9. Add up the total mass of coarse solids to be suspended.
10. Establish the ratio of mass of fine solids to coarse solids.
11. Using the solids concentration of the fine slurry, and adding the coarse solids to be suspended, produce a very thick slurry. This slurry does need to be pumpable.

12. Pour the slurry into a cylinder and let it settle for approximately 10 minutes. Observe the sample for a water layer to break out and monitor if there is an obvious layer of coarse solids building up on the bottom.

13. After about 10 minutes, slowly pour the slurry into a beaker, tipping the cylinder to a maximum angle of 10° above horizontal for 20 to 30 seconds, and observe how much, if any, sediment remains on the bottom of the cylinder.

14. If there is a small amount of sediment on the bottom of the cylinder, then add enough water to the slurry to decrease the solids concentration by approximately 5%.

15. Pour that diluted slurry back into the cylinder.

16. Continue to repeat steps 12 to 14 until a distinct sediment layer has formed on the bottom of the cylinder.

17. The concentration of solids that was the "thinnest" that did not allow coarse solids to settle out within the 10 minutes should be used as the target slurry concentration.

Note: It is recommended that the above procedure be performed by EIMCO's Technology and Development staff prior to utilizing the Biolift® Reactor in a soil remediation flowsheet.

APPENDIX D
BIOTECHNOLOGY APPLICATIONS CENTER
STANDARD OPERATING PROCEDURES

INTERNATIONAL TECHNOLOGY CORPORATION

IT Biotechnology Applications Center
Phosphate Analysis
Standard Operating Procedure

NUMBER: BAC015

Approved By:

Duane Graves 3/13/92

Duane Graves, Ph.D. (Date)
Process Development Supervisor

James J. King 3/13/92

James J. King (Date)
General Manager/QA Officer

Regional Office
312 Directors Drive • Knoxville, Tennessee 37923 • 615-690-3211

STANDARD OPERATING PROCEDURE

PHOSPHATE ANALYSIS

1.0 Principle

Ammonium molybdate and potassium tartrate react in an acid medium with dilute solutions of ortho-phosphate to form phosphomolybdic acid, which is reduced to the intensely-colored molybdenum blue by ascorbic acid. The phosphate analysis is utilized to determine the levels of phosphate present within the samples. Derived from U.S. EPA Method 365.1.

2.0 Equipment

- Bausch & Lomb Spectronic 1001 Spectrophotometer
- HACH PhosVer 3 powder pillows
- 20-milliliter (mL) vials
- 1-, 5-, and 10-mL pipettes
- Deionized (DI) water
- 2,000 parts per million (ppm) KH_2PO_4 standard
- 100-mL volumetric flasks.

3.0 Standards

Standards are generated from a potassium phosphate (KH_2PO_4) 2,000 ppm stock solution. This stock solution is prepared by dissolving 0.285 gram (g) of anhydrous KH_2PO_4 in 100-mL of DI water. This stock is then diluted as indicated in the table below to obtain the indicated concentrations.

KH_2PO_4	Stock DI	Water Conc. (ppm)
0.1 mL	100 mL	2.0
0.05 mL	100 mL	1.0
0.025 mL	100 mL	0.5

4.0 Procedure

1. Prepare a 0.5, 1.0, 2.0 ppm phosphate standards from the 2,000 ppm stock solution of KH_2PO_4.

2. Using a pipette, place 10 mL of each standard into a vial.

3. Add the contents of 1 PhosVer 3 powder pillow and swirl.

4. Allow color to develop for at least 10, but no longer than 30, minutes.

5. Measure the absorbance of a blank (10 mL of DI water with 1 PhosVer 3 powder pillow added) using the spectrophotometer at a wavelength of 700 nanometers (nm).

6. Measure the absorbance of the three standards on the spectrophotometer at a wavelength of 700 nm.

7. Calculate the linear regression curve of the standards and the blank using a programmed calculator.

8. If measuring a groundwater sample, take 10 mL of the sample and add the contents of 1 PhosVer powder pillow and swirl. If the absorbance is higher than the 2.0 ppm standard, then dilute as necessary with DI water. If the absorbance is lower than the 0.5 ppm standard, then the sample is below the detection limit, and it should be reported as such.

9. If the sample is soil, then weigh out one dry scoop of soil in a glass jar with cap. Add 25 mL DI water and add 1 soil extractant pillow. Shake and let stand to separate. When separated, withdraw 1 mL of liquid and add 9 mL of DI water in a separate vial. Sample can be at higher dilutions, but the amount of sample needs to be 10 mL to react with the reagents added. Add 1 PhosVer 3 powder pillow, swirl, and run on spectrophotometer at 700 nm. This gives absorbance.

10. Use the curve generated to determine the concentration of the sample which is reported as mg/kg.

5.0 Calculations

Calculation of the linear regression of the standards is required to determine concentrations of the samples. The curve generated from the standards is then used to determine sample concentrations.

6.0 Interferences

Interferences may be caused by chromium, nitrate, sulfide, and silicate. Interferences are determined by analyzing a 10-mL sample on the spectrophotometer that has been spiked with 0.01 mL of the 2,000 ppm phosphate stock solution. If a difference of greater than 10 percent is observed between the actual and calculated concentrations, interferences are present and dilution of the sample is required to obtain accurate data. Dilution ratios are as follows:

Sample Volume	Water Volume	Dilution Factor
2	8	5
1	9	10
0.5	9.5	20
0.1	9.9	100

7.0 Quality Control Requirements

Quality control (QC) requirements are satisfied through the preparation of blanks (10-mL DI water and 1 PhosVer powder pillow). If a series of samples are to be run, one out of every ten samples are to be blanks. If significant concentration are noted in the blank sample, this concentration is subtracted from the sample concentrations obtained.

INTERNATIONAL TECHNOLOGY CORPORATION

IT Biotechnology Applications Center
Microbial Enumeration Analysis
Standard Operating Procedure

NUMBER: BAC009

Approved By:

Duane Graves 3/13/92

Duane Graves, Ph.D. (Date)
Process Development Supervisor

James J. King 3/13/92

James J. King (Date)
General Manager/QA Officer

KLB/03-92/SMC/enumer.sop

Regional Office
312 Directors Drive • Knoxville, Tennessee 37923 • 615-690-3211

STANDARD OPERATING PROCEDURE

MICROBIAL ENUMERATION ANALYSIS

1.0 Principle

Viable bacterial cells of sufficient quantity are required for effective bioremediation. This test permits the quantification of bacteria from natural environments. Heterotrophs or specific contaminant degrading bacteria can be enumerated. Bacterial density is reported as colony-forming units (CFU) per milliliter (mL) of water or gram (g) of dry soil. A CFU is assumed to represent one bacteria. Derived from Standard Methods for the Examination of Water and Wastewater, 17th Edition.

2.0 Equipment

- Carbon-free mineral salts agar plates
- Dilute nutrient agar plates
- Sterile 1 percent sodium pyrophosphate and 0.1 percent polyvinylpyrrolidone-360 (PVP) in deionized (DI) water
- Sterile 10-mL dilution tubes
- 1-mL sterile disposable pipettes
- Waring blender with steel container
- Sterile 50-mL screw cap tubes
- Alcohol
- Glass plate spreader
- Petri dish turntable

- Volatile hydrocarbon source (gasoline, diesel, benzene, toluene, and xylene [BTX])
- Quebec colony counter.

3.0 Procedure

1. Weigh 5 g of soil/sludge into the blender.

2. Add 45 mL of PVP.

3. Homogenize by running the blender twice at high speed for 10 seconds with a 10-second rest interval between mixings. Decant mixture into 50-mL tube and seal.

4. Perform 10-fold serial dilutions on the homogenized mixture. Aqueous samples are not pretreated with PVP; they are plated as received. The dilution concentrations are determined by the anticipated concentration of bacterial concentrations within the sample. A five order of magnitude range of dilutions is plated.

5. The nutrient agar plates should be plated one order of magnitude higher than the corresponding mineral agar plates.

6. Using the glass plate spreader and turntable, 0.1 mL of the appropriate dilutions is plated on the two types of agar media .

7. Samples plated on the mineral salts agar are placed in the desiccators along with the appropriate hydrocarbon source. Samples plated on the nutrient agar are placed in a protected area away from hydrocarbon sources. Plates are incubated at 20°C.

8. After the appropriate incubation time, the bacterial colonies are counted with the Quebec colony counter. Results are recorded as CFU per mL of groundwater or per gram of dry soil. The inoculated plates should be incubated the same number of days, approximately 3 to 7 days for nutrient agar and 7 to 14 days for mineral agar. The actual incubation time depends on the growth response of the bacteria.

4.0 Calculations

Water samples: Colony Count X Dilution Factor = CFU per mL
Soil samples: (Colony Count X Dilution Factor) X (Wet Wt/Dry Wt) = CFU/gm dry soil.

5.0 Interferences

None.

6.0 QC Requirements

Sterility testing of agar medium.

INTERNATIONAL TECHNOLOGY CORPORATION

IT Biotechnology Application Center
Oxygen Analysis
Standard Operating Procedure

NUMBER: BAC021

Approved By:

Duane Graves 4/1/92

Duane Graves, Ph.D. (Date)
Process Development Supervisor

James J. King 4/2/92

James J. King (Date)
General Manager/QA Officer

Regional Office
312 Directors Drive • Knoxville, Tennessee 37923 • 615-690-3211

STANDARD OPERATING PROCEDURE

OXYGEN ANALYSIS

1.0 Principle

Procedure describes the operation of IT's proprietary oxygen detection system. The system is useful for quantifying gaseous and dissolved oxygen and oxygen chemically combined as hydrogen peroxide. IT Proprietary Method.

2.0 Equipment

- Proprietary oxygen detector (Described by Graves and Greenbaum, 1989, Plant Physiology 90:246-250; Graves, Lang, and Leavitt, 1992, Proceedings AWMA In Situ Waste Treatment Symposium (in press). Software copyrighted by duane Graves, IT Corporation.
- Deionized water
- Catalase enzyme (10,000 to 25,000 units/mL), if hydrogen peroxide is being measured (source is not critical, Aspergillus niger and bovine liver catalase has been used. Sigma Chemical is the supplier.)
- Gas tight syringes, 0-100 μL and 0-500 μL
- 1 mL tuberculin syringes with hypodermic needles (gauge 22, 1 inch works well for most applications

3.0 Standards

Standards for calibrating the detector may be any one of the following depending on the range of oxygen to be quantified:

- Air
- Pure Oxygen
- Oxygenated Water

4.0 Procedure

1. Add water to insure that the septum in the injection port on the oxygen detection device is submerged. Add 0.2 mL of concentrated catalase enzyme to the water if oxygen content of hydrogen peroxide is to be quantified.

2. Start computer, load GWBasic, load and run oxygen program (02488lm), specify parameters as prompted. Select calibration option when it is presented.

3. Specify between 4 and 7 calibration points using either air, oxygen, or aerated water.

4. Inject calibration samples as prompted.

5. Record slope of the calibration line, save the data using an eight (8) character or less fill name.

6. Select "Collect Data" from computer menu.

7. Specify the amount of sample to be injected, follow computer prompts, and inject sample.

8. Save the data to either the computer's hard drive or a floppy disk.

9. Repeat steps 5 through 7 for each sample.

5.0 Calculations

None

6.0 Interferences

1. Changes in flow rate of the purge gas.

2. Changes in temperature greater than 5°C.

7.0 Quality Control Requirements

Aerated, deonized water at known temperature, air, or oxygen samples are routinely measured to verify accuracy of the calibration curve. Quality control samples are injected every two hours or in one of every ten samples. At STP the oxygen content of aerated water should be approximately 9 mg/L, 298 mg/L for air, and 1426 mg/L for oxygen. The precision of the instrument is 1 mg/L under normal operating condition.

INTERNATIONAL TECHNOLOGY CORPORATION

IT Biotechnology Applications Center
Electrometric Ammonia Analysis
Standard Operating Procedure

NUMBER: BAC022

Approved By:

Duane Graves 6/24/92

Duane Graves, Ph.D. (Date)
Process Development Supervisor

James J. King 6/23/92

James J. King (Date)
General Manager/QA Officer

Regional Office
312 Directors Drive • Knoxville, Tennessee 37923 • 615-690-3211

STANDARD OPERATING PROCEDURE

ELECTROMETRIC AMMONIA ANALYSIS

1.0 Principle

The ammonia electrode has the capability of measuring dissolved ammonia in an aqueous solution. A 2M KCl solution is used to extract the ammonia from soil for analysis using the electrode.

2.0 Equipment

- Model 95-12 Orion Ammonia Electrode
- Orion pH/mV meter
- 2M KCl
- Ionic Strength Adjuster (ISA) Solution
- Stir Plate and Stir Bars
- Shaker Table
- 50 ml Centrifuge Tubes
- 30 ml Beakers
- Pipetter and Pipettes
- 1000 ppm NH_4C1 Standard Solution

3.0 Solutions and Standards

A 2M KCl solution is prepared by adding 74.55 gm KCl to 0.5 L DI water. Standards are produced from a 1000 ppm NH_4C1 stock solution. This solution is prepared by adding 3.82 gm NH_4Cl into 1 L of deionized water. 2.5 ml of H_2SO_4 should be added to the stock solution to stabilize the ammonia in the water. Standards should then be diluted as follows:

NH_4 STOCK	2M KCl	CONCENTRATION (ppm)
0.1 mL	100 mL	1.0
1.0 mL	100 mL	10.0
2.0 mL	100 mL	20.0
5.0 mL	100 mL	50.0
10.0 mL	100 mL	100.0

4.0 Procedure

1. Prepare a 1.0, 10.0, 20.0, 50.0, and 100.0 ppm standard solution from the stock solution.

2. Using a pipette, measure 20 mL of each standard into a 30 mL beaker.

3. To each of the standards add 0.4 mL of ISA solution and a stir bar. Allow the standards to stir for a few seconds.

4. Measure the five standards using the pH/mV meter set on the mV mode and the model 95-12 Orion Ammonia Electrode.

5. Calculate the logarithmic curve of the standards using a calculator in the statistical mode.

6. **For soils** - put 5.0 grams of dry, crushed soil into a 50 mL centrifuge tube and add 20 mL of 2M KCl. Seal the tube and place on a shaker table at 250 rpm for at least 1 hour.

7. Place the KCl-soil into a 30 mL beaker. Add a stir bar and place on a stir plate.

8. Add 0.4 mL of the ISA solution to the slurry and allow the slurry to mix for a few seconds.

9. Measure the slurry using the electrode.

10. **For groundwater** - add 0.4 mL of the ISA solution and a stir bar to 20 mL of sample. Stir for a few seconds and read the sample with the electrode.

11. If the mV reading is out of the 1-100 ppm range, then dilute using the 2M KCl solution. If the mV reading is below the 1.0 ppm standard reading, then calculate the reading into a ppm amount. **For soils** multiply by 4 (1:4 is the soil to KCl ratio). If the final ppm is below 1 ppm, then the sample is reported as being below the detection limit.

5.0 Calculations

The curve generated by the calculation of the logarithmic regression of the standard is used to determine the sample concentrations.

6.0 Interferences

Temperature may affect the mV reading, so it is recommended that both standards and samples be analyzed at room temperature. While ionic-species cannot cross the gas-permeable membrane, the level of ions in solution can change the solubility of ammonia. The standards and samples should have about the same level of ions in the solutions.

7.0 Quality Control Requirements

Follow Orion's specification for the model 95-12 Ammonia Electrode.

INTERNATIONAL TECHNOLOGY CORPORATION

IT Biotechnology Applications Center
pH Analysis
Standard Operating Procedure

NUMBER: BAC014

Approved By:

Duane Graves 3/13/92

Duane Graves, Ph.D. (Date)
Process Development Supervisor

James J. King 3/13/92

James J. King (Date)
General Manager/QA Officer

Regional Office
312 Directors Drive • Knoxville, Tennessee 37923 • 615-690-3211

STANDARD OPERATING PROCEDURE

pH ANALYSIS

1.0 Equipment

- 40-milliliter (mL) glass vial
- pH meter with reference electrode
- pH 4, 7, and 10 standardization buffers
- 5-mL pipette
- Deionized (DI) water.

2.0 Procedure

1. Weigh 5 grams (g) of air-dried soil into the 40-mL vial or place 10 mL of aqueous sample into a vial.

2. With the pipette, add 5 mL of DI water.

3. Mix thoroughly for 10 seconds.

4. Let stand for 10 minutes.

5. Calibrate the pH meter with the standardization buffers.

6. Insert the pH electrode into the soil suspension and swirl gently.

7. Read the pH on the calibrated pH meter. Record as soil pH in water.

8. Procedure derived from U.S. EPA Method 150.1 and Methods of Soil Analysis Part 2, Second Edition, pp 206-207.

APPENDIX E
ANTHRACENE MINERALIZATION STUDY

INTERNATIONAL TECHNOLOGY CORPORATION

Memorandum

To: K. Brown, Knoxville

Date: February 16, 1993

From: J. Sanseverino, Knoxville

Subject: ^{14}C-ANTHRACENE MINERALIZATION FOR WESTON

Six Weston batch study samples from t = 3 weeks were analyzed for radiolabeled anthracene mineralization as a confirmation of bacterial activity. All samples were incubated with radiolabeled anthracene (209,000 dpm) for two weeks. Two ml of slurry (in a 25 ml Teflon-sealed vial) from each sample, including the mercuric chloride inhibited controls (#3 and #4), displayed mineralization activity against anthracene. This study will be repeated with t = 6 week samples to determine if there is any change in the activity level. The results indicate that carbon dioxide was produced from the radiolabeled anthracene which is a direct result of microbiological activity.

If you need more information, let me know. I will keep the raw data in my files for now.

Table 1
Percent ^{14}C-carbon dioxide produced from ^{14}C-anthracene from t = 3 week samples.

	Percent ^{14}C-Carbon Dioxide Produced					
Sample	#1	#1 DUP	#2	#2 DUP	#3	#4
Average	13.8	16.5	12.0	12.0	16.6	11.5
SD[1]	1.3	3.6	0.8	0.3	1.9	0.2

[1]SD - Standard Deviation

JS/2-93/js/Kandi29.wes

44-8-85

INTERNATIONAL TECHNOLOGY CORPORATION

Memorandum

To: K. Brown, Knoxville

Date: March 2, 1993

From: J. Sanseverino, Knoxville

Subject: ^{14}C-ANTHRACENE MINERALIZATION FOR WESTON

Six Weston batch study samples from t = 6 weeks were analyzed for radiolabeled anthracene mineralization as a confirmation of bacterial activity. All samples were incubated with radiolabeled anthracene (228,000 dpm) for two weeks. Two ml of slurry (in a 25 ml Teflon-sealed vial) from each sample, including the mercuric chloride inhibited controls (#3 and #4), displayed mineralization activity against anthracene (Table 1). The results indicate that radiolabeled carbon dioxide was produced from the radiolabeled anthracene which is a result of microbiological activity. The amount of radiolabeled carbon dioxide produce at t = 6 weeks is twice as high as the amount of radiolabeled carbon dioxide produced at t = 3 weeks.

Specific anthracene-degrading bacteria were below quantitation limits for the t = 6 week samples (Table 2).

Table 1
Percent ^{14}C-carbon dioxide produced from ^{14}C-anthracene from t = 6 week samples.

	Percent ^{14}C-Carbon Dioxide Produced					
Sample	#1	#1 DUP	#2	#2 DUP	#3	#4
Average	23.7	22.9	23.3	NA[2]	22.2	20.1
SD[1]	1	1	6.1	NA	0.1	3.8

[1]SD - Standard Deviation
[2]NA - Not Available

JS/3-93/js/Kandi29.wes

INTERNATIONAL TECHNOLOGY CORPORATION

Memorandum

To: K. Brown, Knoxville

Date: May 26, 1993

From: J. Sanseverino, Knoxville

Subject: ^{14}C-ANTHRACENE MINERALIZATION FOR WESTON

A sample from the final reactor slurry was received on May 10, 1993 for ^{14}C-anthracene mineralization assay as a confirmation of bacterial activity. Eight vials with 2 milliliters of slurry each were set-up; 3 were used as inhibited controls and 5 were used as test samples. All samples were incubated with radiolabeled anthracene (554,500 dpm) for two weeks. All five replicates displayed mineralization activity against anthracene. An average of 117,600 dpm was recovered as $^{14}CO_2$ which represents 21.2 percent of the added radiolabel. The results indicate that radiolabeled carbon dioxide was produced from the radiolabeled anthracene which is a result of microbiological activity.

If you need more information, let me know. I will keep the raw data in my files for now.

JS/5-93/js/Kandi526.wes

APPENDIX F
NONCONFORMANCE REPORTS

INTERNATIONAL TECHNOLOGY CORPORATION

NONCONFORMANCE REPORT

NR NO. 23
PAGE 1 OF 1
DATE: 3/26/93

PROJECT Weston (Mass-American)
PROJECT NO. 408491

1. NONCONFORMANCE DESCRIPTION

TC measurement of subject soils to use Standard Method 5310B (Infra Red method).

TC measurement have been made using chemical detection rather than infrared. This results as a constraint of the instrument.

IDENTIFIED BY: Craig Lang Kandi Brown DATE: 3/25/93

2. PROPOSED CORRECTIVE ACTION, INCLUDING INITIATION AND COMPLETION DATES

Not Applicable.

No other TC analyzer is available. Results are not expected to affect quality of project.

TO BE PERFORMED BY: _____

3. APPROVAL FOR ~~PROPOSED~~ NO CORRECTIVE ACTION

Kandi Brown — Project Manager — 3/26/93 Date
Timothy S. Stolte — Quality Assurance Coordinator — 3/26/93 Date

4. CORRECTIVE ACTION TAKEN (IF DIFFERENT FROM THAT PROPOSED)

5. CORRECTIVE ACTION COMPLETE

PERFORMED BY: _____ DATE: _____

VERIFIED BY: _____ DATE: _____

CC: PROGRAM MANAGER
PROJECT MANAGER
QUALITY ASSURANCE MANAGER
QUALITY ASSURANCE COORDINATOR
CENTRAL FILES 408491
OTHER:

INTERNATIONAL TECHNOLOGY CORPORATION

NONCONFORMANCE REPORT

NR NO. 02
PAGE 1(
PROJECT Weston (Moss-American)
PROJECT NO. 408491
DATE: 3/26/93

1. NONCONFORMANCE DESCRIPTION

TS/VS measurement originally proposed to adhere to Standard Method 2540 G. Due to an oversight, laboratory personnel were using Standard Method 2540 B. Differences between the 2 methods is restricted to sample volume (1 gram vs 25 grams). The standard deviation determined for TS/VS measurements using 2540 B were 0.57 and 0.15%, respectively. Using the larger sample volume dictated in 2540 G may reduce this variance.

IDENTIFIED BY: Kandi Brown/Kim Truong DATE: 3/25/93

2. PROPOSED CORRECTIVE ACTION, INCLUDING INITIATION AND COMPLETION DATES

For the remainder of the study, both methods will be conducted together to determine variances and effects on data quality. The client will not be charged for additional analyses.

TO BE PERFORMED BY: Janet Rightmyer

3. APPROVAL FOR PROPOSED CORRECTIVE ACTION

K.C. B — 3/26/93
Project Manager — Date

Timothy S. Scott — 3/26
Quality Assurance Coordinator — Date

4. CORRECTIVE ACTION TAKEN (IF DIFFERENT FROM THAT PROPOSED)

5. CORRECTIVE ACTION COMPLETE

PERFORMED BY: Janet Rightmyer DATE: 3/25/93
VERIFIED BY: Kandi Brown DATE: 3/25/93

CC: PROGRAM MANAGER
PROJECT MANAGER
QUALITY ASSURANCE MANAGER
QUALITY ASSURANCE COORDINATOR
CENTRAL FILES 408491
OTHER:

INTERNATIONAL TECHNOLOGY CORPORATION

SAMPLE RECEIPT ACKNOWLEDGEMENT/NONCONFORMANCE

Date: 05/19/93

IT-Biotechnology Applications Center
312 Directors Drive
Knoxville, TN 37923
Attention: Kandi Brown

Project Code : ITDK54104
Client Number : 3083

Subject: Weston

On 05/14/93, one (1) soil sample arrived at the ITAS-Knoxville, Tennessee, laboratory from IT-Biotechnology Applications Center, Knoxville, Tennessee.

The following nonconformance(s) were noted at the time of receipt.

SAMPLE RECEIVED:

- **[ ] Broken/Leaking**
- **[X] Without proper preservative**
- **[ ] In improper container**
- **[ ] With incomplete/unclear paperwork**
- **[ ] Holding time exceeded at time of receipt**
- **[ ] With custody seal missing or broken**
- **[ ] Other**

COMMENTS: The cooler was received at a temperature of 9 deg. C.

CORRECTIVE ACTION:

[ ] Client was verbally notified.

[ ] Client was informed in writing.

[X] Sample(s) processed as received.

[ ] Sample(s) on hold until notified by client.

COMMENTS:

We appreciate this opportunity to offer our services to you. If you have any qestions, please contact me at your earliest convenience.

Project Coordinator: John E Baur **John Baur** **Date:** 5-19-93

Enclosure(s): ARCOC

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311359
Page 1 of 1

Project Name/No.[1] Weston
Sample Team Members[2] C. Lang
Profit Center No.[3] 3521
Project Manager[4] K. Brown
Purchase Order No.[6]
Required Report Date[11]

Samples Shipment Date[7] 5/14/93
Lab Destination[8] ITAS Middlebrook
Lab Contact[9] John Bauer 2666
Project Contact/Phone[12] Kandi Brown ~~2666~~
Carrier/Waybill No.[13]

Bill to:[5] 580000.045
Report to:[10] Kandi Brown
312 Directors Dr.

ONE CONTAINER PER LINE

Sample Number[14]	Sample Description/Type[15]	Date/Time Collected[16]	Container Type[17]	Sample Volume[18]	Preservative[19]	Requested Testing Program[20]	Condition on Receipt[21]	Disposal Record No.[22]
Weston Batch 30% Tweek	slurry	5/14/93	VOA	≈20ml	4°C	Sulfide Test ICAP 6010 for As, Ba, Cd, Cr, Pb	Rec'd at 9°C KMB 5.14.93	9030
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

Special Instructions:[23]

Possible Hazard Identification:[24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal:[25]
Return to Client ☐ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required:[26]
Normal ☐ Rush ☐

QC Level:[27]
I ☐ II ☐ III ☐ Project Specific (specify)

1. Relinquished by[28] (Signature/Affiliation) Cary Lang / IT Bio	Date: 5/14/93 Time: 1500
1. Received by[28] (Signature/Affiliation) Kenya Robinson 5-14-93	Date: 5-14-93 Time: 15:00
2. Relinquished by (Signature/Affiliation)	Date: Time:
2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:
3. Received by (Signature/Affiliation)	Date: Time:

Comments:[29]

ITDK54104

MCA 3/15/91

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

RECORD OF TECHNICAL CHANGE

Technical Change No. BAC001
Project/Job No. 408491
Project/Job Name Weston
Phase/Task

Page 1 of 1
Date 12/8/92

The following technical changes (including justification) are requested by:

Kandi Brown (Name) Project Manager (Title)

① Maintain DO in batch vessels by purging pure O_2 into headspace. Monitor 24 hr consumption of O_2 in headspace. Maintain DO saturated headspace.
② To vessel volumes changed from zero headspace to 900 mL.
③ Use screw cap / teflon lined lids. Pipette samples.
④ Maintain slurry densities at 30 and 40%.
⑤ Prescreened soils using 30 mesh. Wet sieved.
⑥ Approximately lbs of soil needing for testing.
⑦ No stir bar in treatments
⑧ Tube rotator speed open.

The project time will be (Increased)(Decreased)(Unchanged) by approximately 0 days

Applicable Project-Specific Document(s):

EPA Approved Test Plan - Final Revision

CC: G. Diegan, Weston
C. Lang, Knoxville
B. Love, Weston
D. Graves, Knoxville

Approved By: K L. B Date 12/8/92
(Project Manager)
James Date 12/8/92
(Quality Assurance Officer)

Client Notified Yes ✓ No ___ Date 12/8/92
Contract Change Order Required Yes ___ No ✓

Contract Change Order No. ___

Figure ITC0008-1

ITEM	ORIGINAL TEST PLAN	PROPOSED MODIFICATION	RATIONALE
Maintenance of dissolved oxygen during batch testing	Hydrogen peroxide addition to slurry. Daily monitoring of slurry DO using IT oxygen probe.	Pure oxygen purging of headspace. Daily monitoring of DO in headspace. Headspace will be maintained saturated with O_2.	40% slurry density is too thick to be introduced into the oxygen probe. Purging of the headspace with O_2 in combination with continued mixing, will maintain adequate dissolved oxygen in the slurry while maintaining the integrity of the treatments. The use of conventional membrane DO probes was considered, however, they are unreliable in slurries and would require opening the treatments daily.
Batch treatment sampling device	Teflon tubing inserted through a teflon cap. Samples withdrawn using gas-tight syringe.	Teflon septum and teflon screw cap. Sample withdrawn through pipetting.	Slurry density to thick to be withdrawn with original system.
Initial batch treatment volume	1,000 mL or zero headspace	900 mL	The reduced volume does not affect the analytical regime and allows for improved aeration in the event that DO is maintained using O_2 purging.
Batch treatment slurry densities	20 and 30% or Eimco recommendation (pg 4-3 of Test Plan)	30 and 40%	Recommended by Eimco during initial testing.
Stir bars in batch treatments	Each treatment contained a stir bar	No stir bars. Manual mixing prior to sample collection.	During rotation it was feared that the stir bars would break the treatment vessels.
Modified tube rotator speed	200 rpm	6 rpm	Modified tube rotator cannot be safely operated at 200 rpm. 6 rpm provides more than adequate mixing, safely.
Soil quantity	150 lb	10 lb of sieved material for batch study. 165 lb of sieved material for reactor investigation. The estimate volume of unsieved material is approximately 740 lb.	Wet sieving process is producing approximately 42 lb of soil (dry weight)/150 lb sieved. Increased slurry density.

APPENDIX G
BATCH BOTTLE STUDY OXYGEN UTILIZATION DATA

Weston Batch Slurry Study; IT Project No. 408491

TO Oxygen Data

Date		Units	30%	30%-dup	40%	40%-dup	30-k	40-k
12/16	O2	mg/l	174.00	242.00	13.00	52.00	255.00	17.00
	ORP	mV	+32	+15	-58	-70	+26	-58
	Uptake	mg/l-hr	6.14	5.82	6.88	6.70	5.76	6.87
12/17	O2	mg/l	631.00	406.00	384.00	96.00	448.00	2.00
	ORP	mV						
	Uptake	mg/l-hr	4.02	5.06	5.17	6.50	4.87	6.94
12/18	O2	mg/l	824.00	814.00	790.00	726.00	886.00	799.00
	ORP	mV						
	Uptake	mg/l-hr	3.13	3.18	3.29	3.58	2.84	3.25
12/21	O2	mg/l	532.00	541.00	67.00	11.00	585.00	90.00
	ORP	mV						
	Uptake	mg/l-hr	4.48	4.44	6.63	6.89	4.24	6.53
12/22	O2	mg/l	611.00	648.00	122.00	174.00	624.00	99.00
	ORP	mV	206.00	203.00	144.00	130.00	199.00	132.00
	Uptake	mg/l-hr	4.12	3.94	6.38	6.14	4.06	6.49
12/23	O2	mg/l	336.00	355.00	17.00	80.00	396.00	27.00
	ORP	mV						
	Uptake	mg/l-hr	5.39	5.30	6.87	6.57	5.11	6.82
12/28	O2	mg/l	291.00	550.00	NA	NA	888.00	NA
	ORP	mV	198.00	250.00	141.00	160.00	104.00	150.00
	Uptake	mg/l-hr	5.60	4.40	6.94	6.94	2.83	6.94
12/29	O2	mg/l	537.00	497.00	189.00	137.00	631.00	193.00
	ORP	mV						
	Uptake	mg/l-hr	4.46	4.64	6.07	6.31	4.02	6.05
12/30	O2	mg/l	174.00	233.00	2.00	3.00	457.00	5.00
	ORP	mV						
	Uptake	mg/l-hr	6.14	5.87	6.94	6.93	4.83	6.92
12/31	O2	mg/l	150.00	184.00	4.00	3.00	443.00	4.00
	ORP	mV						
	Uptake	mg/l-hr	6.25	6.09	6.93	6.93	4.89	6.93

Weston Batch Slurry Study; IT Project No. 408491

1/4	O2	mg/l	182.00	203.00	3.00	32.00	361.00	3.00
	ORP	mV						
	Uptake	mg/l-hr	6.10	6.00	6.93	6.80	5.27	6.93
1/5	O2	mg/l	88.00	105.00	4.00	6.00	296.00	9.00
	ORP	mV						
	Uptake	mg/l-hr	6.54	6.46	6.93	6.92	5.57	6.90
1/6	O2	mg/l	148.00	179.00	4.00	4.00	360.00	326.00
	ORP	mV						
	Uptake	mg/l-hr	6.26	6.12	6.93	6.93	5.28	5.44
1/7	O2	mg/l	129.00	153.00	19.00	7.00	343.00	314.00
	ORP	mV						
	Uptake	mg/l-hr	6.35	6.24	6.86	6.91	5.36	5.49
1/8	O2	mg/l	688.00	159.00	60.00	7.00	318.00	398.00
	ORP	mV						
	Uptake	mg/l-hr	3.76	6.21	6.67	6.91	5.47	5.10
AVG	O2	mg/l	366.33	351.27	111.87	89.20	486.07	152.40
	ORP	mV	202.00	226.50	142.50	145.00	151.50	141.00
	Uptake	mg/l-hr	5.25	5.32	6.43	6.53	4.69	6.24

Weston Batch Slurry Study; IT Project No. 408491

T3 - Oxygen Data

Date		Units	30%	30%-dup	40%	40%-dup	30-k	40-k
1/11	O2	mg/l						
	ORP	mV	254.00	266.00	52.00	22.00	276.00	147.00
	Uptake	mg/l-hr						
1/12	O2	mg/l	371.00	782.00	820.00	772.00	939.00	879.00
	ORP	mV						
	Uptake	mg/l-hr	47.04	29.92	28.33	30.33	23.38	25.88
1/14	O2	mg/l	491.00	701.00	614.00	814.00	811.00	962.00
	ORP	mV						
	Uptake	mg/l-hr	42.04	33.29	36.92	28.58	28.71	22.42
1/18	O2	mg/l	903.00	858.00	779.00	707.00	877.00	1002.00
	ORP	mV						
	Uptake	mg/l-hr	24.88	26.75	30.04	33.04	25.96	20.75
1/29	O2	mg/l	992.00	957.00	813.00	793.00	848.00	NA
	ORP	mV						
	Uptake	mg/l-hr	21.17	22.63	28.63	29.46	27.17	62.50
AVG	O2	mg/l	551.40	659.60	605.20	617.20	695.00	568.60
	ORP	mV	254.00	266.00	52.00	22.00	276.00	147.00
	Uptake	mg/l-hr	27.03	22.52	24.78	24.28	21.04	26.31

APPENDIX H
ANALYTICAL RESULTS

EPA Method 6010

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

May 26, 1993

Job Number: ITDK 54005

P.O. Number: 580000.045

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston
Date Received by Lab:	05/04/93
Number of Samples:	Three (3)
Sample Type:	Solid

I. Introduction

On 05/04/93, three (3) solid samples arrived at the ITAS-Knoxville, Tennessee, laboratory from IT Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The samples were analyzed for volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8240.

Reviewed and Approved:

Alyce R. Moore
Laboratory Manager

The samples were analyzed for the requested metals by inductively coupled argon plasma spectroscopy (ICP) based on EPA method 6010.

The samples were analyzed for sulfide based on EPA method 9030.

III. Quality Control

Routine laboratory level I QC was followed.

The volatiles analyses were performed by purge and trap with a J & W DB-624 megabore column on a Finnigan OWA GC/MS/DS. The sample showed poor surrogate recoveries and was reanalyzed. The results of the second analysis were consistent with the first results, indicating that the matrix was responsible for the outliers. Both sets of data were submitted for comparison. There were no problems seen in final data review.

The samples were digested on 05/14/93 for ICP; the requested metals were analyzed by ICP on 05/20/93. All run QC was acceptable. No problems were encountered.

The samples were analyzed for sulfide by iodometric titration. Two grams of sample were added to 200 n of DI water; the solution was agitated with a magnetic stirrer and titrated according to the referenced method. The results are reported as water-leachable concentrations of the analyte. No problems were encountered.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: RX Slurry
Lab Sample ID: XX3102

Compound	Concentration	Compound	Concentration
chloromethane	29 U	1,2-dichloropropane	14 U
bromomethane	29 U	cis-1,3-dichloropropene	14 U
vinyl chloride	29 U	trichloroethene	14 U
chloroethane	29 U	dibromochloromethane	14 U
methylene chloride	12 BJ	1,1,2-trichloroethane	14 U
acetone	29 U	benzene	14 U
carbon disulfide	14 U	trans-1,3-dichloropropene	14 U
1,1-dichloroethene	14 U	bromoform	14 U
1,1-dichloroethane	14 U	4-methyl-2-pentanone	29 U
1,2-dichloroethene (total)	14 U	2-hexanone	29 U
chloroform	14 U	tetrachloroethene	14 U
1,2-dichloroethane	14 U	1,1,2,2-tetrachloroethane	14 U
2-butanone	29 U	toluene	14 U
1,1,1-trichloroethane	14 U	chlorobenzene	14 U
carbon tetrachloride	14 U	ethylbenzene	14 U
vinyl acetate	29 U	styrene	14 U
bromodichloromethane	14 U	xylenes (total)	14 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 05/18/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: RX Slurry
Lab Sample ID: XX3102

Tentative Identification (1)	Concentration (2)
None detected	

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: RX Slurry RE
Lab Sample ID: XX3102

Compound	Concentration		Compound	Concentration	
chloromethane	29	U	1,2-dichloropropane	14	U
bromomethane	29	U	cis-1,3-dichloropropene	14	U
vinyl chloride	29	U	trichloroethene	14	U
chloroethane	29	U	dibromochloromethane	14	U
methylene chloride	50	B	1,1,2-trichloroethane	14	U
acetone	16	BJ	benzene	14	U
carbon disulfide	14	U	trans-1,3-dichloropropene	14	U
1,1-dichloroethene	14	U	bromoform	14	U
1,1-dichloroethane	14	U	4-methyl-2-pentanone	29	U
1,2-dichloroethene (total)	14	U	2-hexanone	29	U
chloroform	14	U	tetrachloroethene	14	U
1,2-dichloroethane	14	U	1,1,2,2-tetrachloroethane	14	U
2-butanone	29	U	toluene	14	U
1,1,1-trichloroethane	14	U	chlorobenzene	14	U
carbon tetrachloride	14	U	ethylbenzene	14	U
vinyl acetate	29	U	styrene	14	U
bromodichloromethane	14	U	xylenes (total)	14	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
B - Analyte was found in the blank as well as the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 05/18/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: RX Slurry RE
Lab Sample ID: XX3102

Tentative Identification (1)	Concentration (2)
None detected	

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB0518

Compound	Concentration		Compound	Concentration	
chloromethane	10	U	1,2-dichloropropane	5	U
bromomethane	10	U	cis-1,3-dichloropropene	5	U
vinyl chloride	10	U	trichloroethene	5	U
chloroethane	10	U	dibromochloromethane	5	U
methylene chloride	4	J	1,1,2-trichloroethane	5	U
acetone	7	J	benzene	5	U
carbon disulfide	5	U	trans-1,3-dichloropropene	5	U
1,1-dichloroethene	5	U	bromoform	5	U
1,1-dichloroethane	5	U	4-methyl-2-pentanone	10	U
1,2-dichloroethene (total)	5	U	2-hexanone	10	U
chloroform	5	U	tetrachloroethene	5	U
1,2-dichloroethane	5	U	1,1,2,2-tetrachloroethane	5	U
2-butanone	10	U	toluene	5	U
1,1,1-trichloroethane	5	U	chlorobenzene	5	U
carbon tetrachloride	5	U	ethylbenzene	5	U
vinyl acetate	10	U	styrene	5	U
bromodichloromethane	5	U	xylenes (total)	5	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 05/18/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB0518

Tentative Identification (1)	Concentration (2)
None detected	

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

	VOLATILE		
Client Sample ID	Toluene-D8 (81-117%)*	BFB (74-121%)*	1,2 Dichloroethane-D4 (70-121%)*
RX Slurry	116	66 **	92
RX Slurry RE	126 **	64 **	98
Method Blank	100	93	97

* - Values in parenthesis represent QC limits.
** - Values outside required QC limits.

PRIORITY POLLUTANT METALS ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID: Effluent 1-3
Lab Sample ID: XX3103

Compound	Concentration
arsenic	11.8
barium	45.5
cadmium	1.7
chromium	8.4
lead	32.0

Digestion Date: 05/14/93
Analysis Date: 05/20/93

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
B - Value greater than instrument detection limit, but less than contract required quantitation limit.

PRIORITY POLLUTANT METALS ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID: INF32693-02
Lab Sample ID: XX3104

Compound	Concentration
arsenic	35.3
barium	61.7
cadmium	1.2
chromium	8.1
lead	29.6

Digestion Date: 05/14/93
Analysis Date: 05/20/93

PRIORITY POLLUTANT METALS ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID: RX Slurry
Lab Sample ID: XX3105

Compound	Concentration
arsenic	27.2
barium	62.9
cadmium	1.8
chromium	10.0
lead	32.4

Digestion Date: 05/14/93
Analysis Date: 05/20/93

PRIORITY POLLUTANT METALS ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: PBS-I2370

Compound	Concentration	
arsenic	4.000	U
barium	0.200	U
cadmium	0.500	U
chromium	1.000	U
lead	4.000	U

Digestion Date: 05/14/93
Analysis Date: 05/20/93

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

SULFIDE ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID	Lab Sample ID	Result
Method Blank	P5050	40 U
Effluent 1-3	XX3106	480
Rx Slurry	XX3107	140

Date of Analysis: 05/11/93

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

EFFLUENT 1-3

Lab Name: ITAS_KNOXVILLE Contract: WESTON

Lab Code: ITSTU_ Case No.: 54005 SAS No.: _____ SDG No.: EFFLUE

Matrix (soil/water): SOIL_ Lab Sample ID: XX3103

Level (low/med): LOW_ Date Received: 05/04/93

% Solids: 100.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic	11.8			P
7440-39-3	Barium	45.5			P
7440-41-7	Beryllium				NR
7440-43-9	Cadmium	1.7			P
7440-70-2	Calcium				NR
7440-47-3	Chromium	8.4			P
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead	32.0			P
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: BROWN Clarity Before: _____ Texture: SLUDGE

Color After: YELLOW Clarity After: CLEAR Artifacts: _____

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
INF32693-02

Lab Name: ITAS_KNOXVILLE Contract: WESTON

Lab Code: ITSTU Case No.: 54005 SAS No.: SDG No.: EFFLUE

Matrix (soil/water): SOIL Lab Sample ID: XX3104

Level (low/med): LOW Date Received: 05/04/93

% Solids: 100.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic	✓ 35.3			P
7440-39-3	Barium	✓ 61.7			P
7440-41-7	Beryllium				NR
7440-43-9	Cadmium	✓ 1.2			P
7440-70-2	Calcium				NR
7440-47-3	Chromium	✓ 8.1			P
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead	✓ 29.6			P
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: SLUDGE

Color After: YELLOW Clarity After: CLEAR Artifacts:

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

RX SLURRY

Lab Name: ITAS_KNOXVILLE Contract: WESTON

Lab Code: ITSTU_ Case No.: 54005 SAS No.: _____ SDG No.: EFFLUE

Matrix (soil/water): SOIL_ Lab Sample ID: XX3105

Level (low/med): LOW_ Date Received: 05/04/93

% Solids: 100.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum				NR
7440-36-0	Antimony				NR
7440-38-2	Arsenic	✓ 27.2			P
7440-39-3	Barium	✓ 62.9			P
7440-41-7	Beryllium				NR
7440-43-9	Cadmium	✓ 1.8			P
7440-70-2	Calcium				NR
7440-47-3	Chromium	✓ 10.0			P
7440-48-4	Cobalt				NR
7440-50-8	Copper				NR
7439-89-6	Iron				NR
7439-92-1	Lead	✓ 32.4			P
7439-95-4	Magnesium				NR
7439-96-5	Manganese				NR
7439-97-6	Mercury				NR
7440-02-0	Nickel				NR
7440-09-7	Potassium				NR
7782-49-2	Selenium				NR
7440-22-4	Silver				NR
7440-23-5	Sodium				NR
7440-28-0	Thallium				NR
7440-62-2	Vanadium				NR
7440-66-6	Zinc				NR
	Cyanide				NR

Color Before: BROWN Clarity Before: _____ Texture: SLUDGE

Color After: YELLOW Clarity After: CLEAR Artifacts: _____

Comments:

FORM I - IN

3/90

Data entered by: JLM

Corrected by: DEW

Data QC'd by: [signature] 5/26/93

IT ANALYTICAL SERVICES--KNOXVILLE, TN

Project Code	Matrix	Parameter	Client I.D.	Lab I.D.	Sample Results	Result Qual.	Blank I.D.	Blank Results	Blank Qual.	Analysis Date	Analys
ITDK54005	SOLID	SULFIDE	EFFLUENT 1-3	XX3106	480 mg/Kg	+	P5050	10 mg/Kg	U	05/11/93	JLM
			Rx SLURRY	XX3107	140 mg/Kg	+	P5050	10 mg/Kg	U	05/11/93	JLM

U = Compound was analyzed for but not detected.
The number is the detection limit for the sample.
+ = A method blank is not applicable for this analysis.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

June 18, 1993

Job Number: ITDK 54104

P.O. Number: 580000.045

This is the Certificate of Analysis for the following sample:

Client Project ID:	Weston
Date Received by Lab:	05/14/93
Number of Samples:	One (1)
Sample Type:	Soil

I. Introduction

On 05/14/93, one (1) soil sample arrived at the ITAS-Knoxville, Tennessee, laboratory from IT-Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The sample was analyzed for the requested metals by inductively coupled argon plasma spectroscopy (ICP) based on EPA method by method 6010.

The sample was analyzed for sulfide based on EPA method 376.1.

Reviewed and Approved:

Alyce R. Moore

Alyce R. Moore
Laboratory Manager

III. Quality Control

Routine laboratory level I QC was followed.

The sample was digested on 06/04/93 for ICP; the requested metals were analyzed by ICP on 06/08/93. No problems were encountered.

The sample was analyzed for sulfide by iodometric titration. Two grams of sample were added to 200 ml of DI water; the solution was agitated with a magnetic stirrer and titrated according to the referenced method. The results are reported as water-leachable concentrations of the analyte. No major problems were encountered.

IT Corporation
June 18, 1993

Client Project ID: Weston

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Job Number: ITDK 54104

METALS ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID:	Method Blank	Weston Batch 30% T6 Week
Lab Sample ID:	PBS-I2521	XX4226
arsenic	4 U	20
barium	0.2 U	64.5
cadmium	0.5 U	3.2
chromium	1 U	10
lead	4 U	43

Digestion Date: 06/04/93
Analysis Date: 06/08/93 (ICP)

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

IT Corporation
June 18, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 54104

SULFIDE ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID	Lab Sample ID	Result
Weston Batch 30% T6 Week	XX4226	520
Method Blank	P5083	100 U

Date of Analysis: 05/18/93

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

EPA Method 8270

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

April 30, 1993

Job Number: ITDK 53741

P.O. Number: 580000.045

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston
Date Received by Lab:	04/01/93
Number of Samples:	Two (2)
Sample Type:	Slurry

I. Introduction

On 04/01/93, two (2) slurry samples arrived at the ITAS-Knoxville, Tennessee, laboratory from IT Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The samples were analyzed for semivolatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8270.

The samples were analyzed for halogenated volatile organic compounds by gas chromatography based on EPA SW-846 method 8010.

Reviewed and Approved:

Alyce R. Moore
Laboratory Manager

III. Quality Control

Routine laboratory level I QC was followed.

The semivolatiles analyses were performed by direct injection of sample extract on a Restek XTI-5 capillary column on a Fisons VG TRIO-1 GC/MS/DS unit. The sample analyses generally went well. The high levels of organic material in the sample matrix caused low surrogate recoveries in the original low level extractions of Rx 4/1/93 and Influent Feed. The reextractions of these samples were done at a medium level to lessen the effects of matrix. This was successful in providing compliant surrogate recoveries; however, the reextractions were eight days beyond sample holding times. The medium level reextractions typically detected the same target compounds, but at slightly higher levels. It was considered that the data from the medium reextractions more accurately reflects the target compound levels in the samples. Both sets of data were reported for comparison. There were no other problems seen in final data review.

The samples were analyzed for halogenated volatile organics by gas chromatography/photoionization and electrolytic conductivity (Hall) detection in series using an RTX 502.2 column on a Varian 3400 GC. No major problems were encountered.

SEMIVOLATILE ORGANIC COMPOUNDS
Results in µg/kg (ppb)
Sample Matrix: Soil

Client Sample ID: Rx 4/1/93
Lab Sample ID: VV9652

Compound	Concentration		Compound	Concentration	
phenol	37,000	U	bis(2-chloroethoxy)methane	37,000	U
bis(2-chloroethyl)ether	37,000	U	2,4-dichlorophenol	37,000	U
2-chlorophenol	37,000	U	1,2,4-trichlorobenzene	37,000	U
1,3-dichlorobenzene	37,000	U	naphthalene	37,000	U
1,4-dichlorobenzene	37,000	U	4-chloroaniline	37,000	U
benzyl alcohol	37,000	U	hexachlorobutadiene	37,000	U
1,2-dichlorobenzene	37,000	U	4-chloro-3-methylphenol	37,000	U
2-methylphenol	37,000	U	2-methylnaphthalene	37,000	U
bis(2-chloroisopropyl)ether	37,000	U	hexachlorocyclopentadiene	37,000	U
4-methylphenol	37,000	U	2,4,6-trichlorophenol	37,000	U
n-nitroso-di-n-propylamine	37,000	U	2,4,5-trichlorophenol	180,000	U
hexachloroethane	37,000	U	2-chloronaphthalene	37,000	U
nitrobenzene	37,000	U	2-nitroaniline	180,000	U
isophorone	37,000	U	dimethyl phthalate	37,000	U
2-nitrophenol	37,000	U	acenaphthylene	37,000	U
2,4-dimethylphenol	37,000	U	2,6-dinitrotoluene	37,000	U
benzoic acid	180,000	U			

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Extraction: 04/14/93
Date of Analysis: 04/21/93

SEMIVOLATILE ORGANIC COMPOUNDS (continued)
Results in µg/kg (ppb)
Sample Matrix: Soil

Client Sample ID: Rx 4/1/93
Lab Sample ID: VV9652

Compound	Concentration		Compound	Concentration	
3-nitroaniline	180,000	U	anthracene	4,000	J
acenaphthene	37,000	U	di-n-butylphthalate	37,000	U
2,4-dinitrophenol	180,000	U	fluoranthene	15,000	J
4-nitrophenol	180,000	U	pyrene	12,000	J
dibenzofuran	37,000	U	butylbenzylphthalate	37,000	U
2,4-dinitrotoluene	37,000	U	3,3'-dichlorobenzidine	75,000	U
diethylphthalate	37,000	U	benzo(a)anthracene	37,000	U
4-chlorophenyl-phenylether	37,000	U	chrysene	37,000	U
fluorene	4,400	J	bis(2-ethylhexyl)phthalate	37,000	U
4-nitroaniline	180,000	U	di-n-octylphthalate	37,000	U
4,6-dinitro-2-methylphenol	180,000	U	benzo(b)fluoranthene	37,000	U
n-nitrosodiphenylamine[1]	37,000	U	benzo(k)fluoranthene	37,000	U
4-bromophenyl-phenylether	37,000	U	benzo(a)pyrene	37,000	U
hexachlorobenzene	37,000	U	indeno(1,2,3-cd)pyrene	37,000	U
pentachlorophenol	180,000	U	dibenzo(a,h)anthracene	37,000	U
phenanthrene	5,500	J	benzo(g,h,i)perylene	37,000	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
1 - Cannot be separated from diphenylamine.

Date of Extraction: 04/14/93
Date of Analysis: 04/21/93

IT Corporation
April 30, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 53741

ADDITIONAL SEMIVOLATILE ORGANIC ANALYSIS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx 4/1/93
Lab Sample ID: VV9652

Tentative Identification (1)	Concentration (2)
2-pentanone, 4-hydroxy-4-met	35,000 A

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

A - Suspected aldol condensation product.

SEMIVOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)
Sample Matrix: Soil

Client Sample ID: Rx 4/1/93 RE
Lab Sample ID: VV9652

Compound	Concentration		Compound	Concentration	
phenol	110,000	U	bis(2-chloroethoxy)methane	110,000	U
bis(2-chloroethyl)ether	110,000	U	2,4-dichlorophenol	110,000	U
2-chlorophenol	110,000	U	1,2,4-trichlorobenzene	110,000	U
1,3-dichlorobenzene	110,000	U	naphthalene	110,000	U
1,4-dichlorobenzene	110,000	U	4-chloroaniline	110,000	U
benzyl alcohol	110,000	U	hexachlorobutadiene	110,000	U
1,2-dichlorobenzene	110,000	U	4-chloro-3-methylphenol	110,000	U
2-methylphenol	110,000	U	2-methylnaphthalene	110,000	U
bis(2-chloroisopropyl)ether	110,000	U	hexachlorocyclopentadiene	110,000	U
4-methylphenol	110,000	U	2,4,6-trichlorophenol	110,000	U
n-nitroso-di-n-propylamine	110,000	U	2,4,5-trichlorophenol	550,000	U
hexachloroethane	110,000	U	2-chloronaphthalene	110,000	U
nitrobenzene	110,000	U	2-nitroaniline	550,000	U
isophorone	110,000	U	dimethyl phthalate	110,000	U
2-nitrophenol	110,000	U	acenaphthylene	110,000	U
2,4-dimethylphenol	110,000	U	2,6-dinitrotoluene	110,000	U
benzoic acid	550,000	U			

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Extraction: 04/23/93
Date of Analysis: 04/27/93

SEMIVOLATILE ORGANIC COMPOUNDS (continued)

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx 4/1/93 RE
Lab Sample ID: VV9652

Compound	Concentration		Compound	Concentration	
3-nitroaniline	550,000	U	anthracene	23,000	J
acenaphthene	110,000	U	di-n-butylphthalate	110,000	U
2,4-dinitrophenol	550,000	U	fluoranthene	83,000	J
4-nitrophenol	550,000	U	pyrene	58,000	J
dibenzofuran	110,000	U	butylbenzylphthalate	110,000	U
2,4-dinitrotoluene	110,000	U	3,3'-dichlorobenzidine	230,000	U
diethylphthalate	110,000	U	benzo(a)anthracene	20,000	J
4-chlorophenyl-phenylether	110,000	U	chrysene	17,000	J
fluorene	18,000	J	bis(2-ethylhexyl)phthalate	110,000	U
4-nitroaniline	550,000	U	di-n-octylphthalate	110,000	U
4,6-dinitro-2-methylphenol	550,000	U	benzo(b)fluoranthene	110,000	U
n-nitrosodiphenylamine[1]	110,000	U	benzo(k)fluoranthene	13,000	J
4-bromophenyl-phenylether	110,000	U	benzo(a)pyrene	13,000	J
hexachlorobenzene	110,000	U	indeno(1,2,3-cd)pyrene	110,000	U
pentachlorophenol	550,000	U	dibenzo(a,h)anthracene	110,000	U
phenanthrene	18,000	J	benzo(g,h,i)perylene	110,000	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
1 - Cannot be separated from diphenylamine.

Date of Extraction: 04/23/93
Date of Analysis: 04/27/93

ADDITIONAL SEMIVOLATILE ORGANIC ANALYSIS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx 4/1/93 RE
Lab Sample ID: VV9652

Tentative Identification (1)	Concentration (2)
3-pentenoic acid, 4-methyl-	51,000 A

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

A - Suspected aldol condensation product.

SEMIVOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)
Sample Matrix: Soil

Client Sample ID: Influent Feed 3/26/93
Lab Sample ID: VV9653

Compound	Concentration		Compound	Concentration	
phenol	13,000	U	bis(2-chloroethoxy)methane	13,000	U
bis(2-chloroethyl)ether	13,000	U	2,4-dichlorophenol	13,000	U
2-chlorophenol	13,000	U	1,2,4-trichlorobenzene	13,000	U
1,3-dichlorobenzene	13,000	U	naphthalene	2,700	J
1,4-dichlorobenzene	13,000	U	4-chloroaniline	13,000	U
benzyl alcohol	13,000	U	hexachlorobutadiene	13,000	U
1,2-dichlorobenzene	13,000	U	4-chloro-3-methylphenol	13,000	U
2-methylphenol	13,000	U	2-methylnaphthalene	13,000	U
bis(2-chloroisopropyl)ether	13,000	U	hexachlorocyclopentadiene	13,000	U
4-methylphenol	13,000	U	2,4,6-trichlorophenol	13,000	U
n-nitroso-di-n-propylamine	13,000	U	2,4,5-trichlorophenol	61,000	U
hexachloroethane	13,000	U	2-chloronaphthalene	13,000	U
nitrobenzene	13,000	U	2-nitroaniline	61,000	U
isophorone	13,000	U	dimethyl phthalate	13,000	U
2-nitrophenol	13,000	U	acenaphthylene	1,600	J
2,4-dimethylphenol	13,000	U	2,6-dinitrotoluene	13,000	U
benzoic acid	61,000	U			

J - Indicates an estimated value less than the detection limit.
U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Extraction: 04/14/93
Date of Analysis: 04/21/93

SEMIVOLATILE ORGANIC COMPOUNDS (continued)

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Influent Feed 3/26/93
Lab Sample ID: VV9653

Compound	Concentration		Compound	Concentration	
3-nitroaniline	61,000	U	anthracene	16,000	
acenaphthene	10,000	J	di-n-butylphthalate	13,000	U
2,4-dinitrophenol	61,000	U	fluoranthene	52,000	
4-nitrophenol	61,000	U	pyrene	33,000	
dibenzofuran	6,300	J	butylbenzylphthalate	13,000	U
2,4-dinitrotoluene	13,000	U	3,3'-dichlorobenzidine	25,000	U
diethylphthalate	13,000	U	benzo(a)anthracene	10,000	J
4-chlorophenyl-phenylether	13,000	U	chrysene	13,000	
fluorene	13,000		bis(2-ethylhexyl)phthalate	13,000	U
4-nitroaniline	61,000	U	di-n-octylphthalate	13,000	U
4,6-dinitro-2-methylphenol	61,000	U	benzo(b)fluoranthene	7,600	J
n-nitrosodiphenylamine[1]	13,000	U	benzo(k)fluoranthene	13,000	U
4-bromophenyl-phenylether	13,000	U	benzo(a)pyrene	6,400	J
hexachlorobenzene	13,000	U	indeno(1,2,3-cd)pyrene	1,600	J
pentachlorophenol	61,000	U	dibenzo(a,h)anthracene	13,000	U
phenanthrene	43,000		benzo(g,h,i)perylene	13,000	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
1 - Detected as diphenylamine.

Date of Extraction: 04/14/93
Date of Analysis: 04/21/93

ADDITIONAL SEMIVOLATILE ORGANIC ANALYSIS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Influent Feed 3/26/93
Lab Sample ID: VV9653

Tentative Identification (1)	Concentration (2)	
2-pentanone, 4-hydroxy-4-met	29,000	A
4H-cyclopenta def phenanthre	15,000	
hexanedioic acid, dioctyl es	6,000	
11H-benzo a fluorene	6,000	
1H-indene, 1-phenyl-	5,700	

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

A - Suspected aldol condensation product.

SEMIVOLATILE ORGANIC COMPOUNDS
Results in µg/kg (ppb)
Sample Matrix: Soil

Client Sample ID: Influent Feed 3/26/93 R
Lab Sample ID: VV9653

Compound	Concentration		Compound	Concentration	
phenol	87,000	U	bis(2-chloroethoxy)methane	87,000	U
bis(2-chloroethyl)ether	87,000	U	2,4-dichlorophenol	87,000	U
2-chlorophenol	87,000	U	1,2,4-trichlorobenzene	87,000	U
1,3-dichlorobenzene	87,000	U	naphthalene	87,000	U
1,4-dichlorobenzene	87,000	U	4-chloroaniline	87,000	U
benzyl alcohol	87,000	U	hexachlorobutadiene	87,000	U
1,2-dichlorobenzene	87,000	U	4-chloro-3-methylphenol	87,000	U
2-methylphenol	87,000	U	2-methylnaphthalene	87,000	U
bis(2-chloroisopropyl)ether	87,000	U	hexachlorocyclopentadiene	87,000	U
4-methylphenol	87,000	U	2,4,6-trichlorophenol	87,000	U
n-nitroso-di-n-propylamine	87,000	U	2,4,5-trichlorophenol	420,000	U
hexachloroethane	87,000	U	2-chloronaphthalene	87,000	U
nitrobenzene	87,000	U	2-nitroaniline	420,000	U
isophorone	87,000	U	dimethyl phthalate	87,000	U
2-nitrophenol	87,000	U	acenaphthylene	9,500	J
2,4-dimethylphenol	87,000	U	2,6-dinitrotoluene	87,000	U
benzoic acid	420,000	U			

J - Indicates an estimated value less than the detection limit.
U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Extraction: 04/23/93
Date of Analysis: 04/27/93

SEMIVOLATILE ORGANIC COMPOUNDS (continued)

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Influent Feed 3/26/93 R
Lab Sample ID: VV9653

Compound	Concentration		Compound	Concentration	
3-nitroaniline	420,000	U	anthracene	33,000	J
acenaphthene	25,000	J	di-n-butylphthalate	87,000	U
2,4-dinitrophenol	420,000	U	fluoranthene	140,000	
4-nitrophenol	420,000	U	pyrene	100,000	
dibenzofuran	13,000	J	butylbenzylphthalate	87,000	U
2,4-dinitrotoluene	87,000	U	3,3'-dichlorobenzidine	170,000	U
diethylphthalate	87,000	U	benzo(a)anthracene	32,000	J
4-chlorophenyl-phenylether	87,000	U	chrysene	28,000	J
fluorene	32,000	J	bis(2-ethylhexyl)phthalate	87,000	U
4-nitroaniline	420,000	U	di-n-octylphthalate	87,000	U
4,6-dinitro-2-methylphenol	420,000	U	benzo(b)fluoranthene	13,000	J
n-nitrosodiphenylamine[1]	87,000	U	benzo(k)fluoranthene	22,000	J
4-bromophenyl-phenylether	87,000	U	benzo(a)pyrene	19,000	J
hexachlorobenzene	87,000	U	indeno(1,2,3-cd)pyrene	87,000	U
pentachlorophenol	420,000	U	dibenzo(a,h)anthracene	87,000	U
phenanthrene	64,000	J	benzo(g,h,i)perylene	87,000	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
1 - Cannot be separated from diphenylamine.

Date of Extraction: 04/23/93
Date of Analysis: 04/27/93

ADDITIONAL SEMIVOLATILE ORGANIC ANALYSIS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Influent Feed 3/26/93 RE
Lab Sample ID: VV9653

Tentative Identification (1)	Concentration (2)
None detected	

SEMIVOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)
Sample Matrix: Soil

Client Sample ID: Method Blank 1
Lab Sample ID: H3692

Compound	Concentration		Compound	Concentration	
phenol	330	U	bis(2-chloroethoxy)methane	330	U
bis(2-chloroethyl)ether	330	U	2,4-dichlorophenol	330	U
2-chlorophenol	330	U	1,2,4-trichlorobenzene	330	U
1,3-dichlorobenzene	330	U	naphthalene	330	U
1,4-dichlorobenzene	330	U	4-chloroaniline	330	U
benzyl alcohol	330	U	hexachlorobutadiene	330	U
1,2-dichlorobenzene	330	U	4-chloro-3-methylphenol	330	U
2-methylphenol	330	U	2-methylnaphthalene	330	U
bis(2-chloroisopropyl)ether	330	U	hexachlorocyclopentadiene	330	U
4-methylphenol	330	U	2,4,6-trichlorophenol	330	U
n-nitroso-di-n-propylamine	330	U	2,4,5-trichlorophenol	1,600	U
hexachloroethane	330	U	2-chloronaphthalene	330	U
nitrobenzene	330	U	2-nitroaniline	1,600	U
isophorone	330	U	dimethyl phthalate	330	U
2-nitrophenol	330	U	acenaphthylene	330	U
2,4-dimethylphenol	330	U	2,6-dinitrotoluene	330	U
benzoic acid	1,600	U			

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Extraction: 04/14/93
Date of Analysis: 04/21/93

SEMIVOLATILE ORGANIC COMPOUNDS (continued)

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank 1
Lab Sample ID: H3692

Compound	Concentration		Compound	Concentration	
3-nitroaniline	1,600	U	anthracene	330	U
acenaphthene	330	U	di-n-butylphthalate	330	U
2,4-dinitrophenol	1,600	U	fluoranthene	330	U
4-nitrophenol	1,600	U	pyrene	330	U
dibenzofuran	330	U	butylbenzylphthalate	330	U
2,4-dinitrotoluene	330	U	3,3'-dichlorobenzidine	660	U
diethylphthalate	330	U	benzo(a)anthracene	330	U
4-chlorophenyl-phenylether	330	U	chrysene	330	U
fluorene	330	U	bis(2-ethylhexyl)phthalate	330	U
4-nitroaniline	1,600	U	di-n-octylphthalate	330	U
4,6-dinitro-2-methylphenol	1,600	U	benzo(b)fluoranthene	330	U
n-nitrosodiphenylamine[1]	330	U	benzo(k)fluoranthene	330	U
4-bromophenyl-phenylether	330	U	benzo(a)pyrene	330	U
hexachlorobenzene	330	U	indeno(1,2,3-cd)pyrene	330	U
pentachlorophenol	1,600	U	dibenzo(a,h)anthracene	330	U
phenanthrene	330	U	benzo(g,h,i)perylene	330	U

This method blank applies to samples Influent Feed 3/26/93 and Rx 4/1/93.

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
1 - Cannot be separated from diphenylamine.

Date of Extraction: 04/14/93
Date of Analysis: 04/21/93

ADDITIONAL SEMIVOLATILE ORGANIC ANALYSIS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank 1
Lab Sample ID: H3692

Tentative Identification (1)	Concentration (2)	
2-propanol, 2-nitroso-, acet	2,500	A
butanoic acid, 4-chloro-	160	
2-pentanone, 5-(acetyloxy)-	140	A

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

A - Suspected aldol condensation product.

SEMIVOLATILE ORGANIC COMPOUNDS
Results in µg/kg (ppb)
Sample Matrix: Soil

Client Sample ID: Method Blank 2
Lab Sample ID: H3834

Compound	Concentration		Compound	Concentration	
phenol	5,000	U	bis(2-chloroethoxy)methane	5,000	U
bis(2-chloroethyl)ether	5,000	U	2,4-dichlorophenol	5,000	U
2-chlorophenol	5,000	U	1,2,4-trichlorobenzene	5,000	U
1,3-dichlorobenzene	5,000	U	naphthalene	5,000	U
1,4-dichlorobenzene	5,000	U	4-chloroaniline	5,000	U
benzyl alcohol	5,000	U	hexachlorobutadiene	5,000	U
1,2-dichlorobenzene	5,000	U	4-chloro-3-methylphenol	5,000	U
2-methylphenol	5,000	U	2-methylnaphthalene	5,000	U
bis(2-chloroisopropyl)ether	5,000	U	hexachlorocyclopentadiene	5,000	U
4-methylphenol	5,000	U	2,4,6-trichlorophenol	5,000	U
n-nitroso-di-n-propylamine	5,000	U	2,4,5-trichlorophenol	24,000	U
hexachloroethane	5,000	U	2-chloronaphthalene	5,000	U
nitrobenzene	5,000	U	2-nitroaniline	24,000	U
isophorone	5,000	U	dimethyl phthalate	5,000	U
2-nitrophenol	5,000	U	acenaphthylene	5,000	U
2,4-dimethylphenol	5,000	U	2,6-dinitrotoluene	5,000	U
benzoic acid	24,000	U			

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Extraction: 04/23/93
Date of Analysis: 04/27/93

SEMIVOLATILE ORGANIC COMPOUNDS (continued)

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank 2
Lab Sample ID: H3834

Compound	Concentration		Compound	Concentration	
3-nitroaniline	24,000	U	anthracene	5,000	U
acenaphthene	5,000	U	di-n-butylphthalate	5,000	U
2,4-dinitrophenol	24,000	U	fluoranthene	5,000	U
4-nitrophenol	24,000	U	pyrene	5,000	U
dibenzofuran	5,000	U	butylbenzylphthalate	5,000	U
2,4-dinitrotoluene	5,000	U	3,3'-dichlorobenzidine	9,900	U
diethylphthalate	5,000	U	benzo(a)anthracene	5,000	U
4-chlorophenyl-phenylether	5,000	U	chrysene	5,000	U
fluorene	5,000	U	bis(2-ethylhexyl)phthalate	5,000	U
4-nitroaniline	24,000	U	di-n-octylphthalate	5,000	U
4,6-dinitro-2-methylphenol	24,000	U	benzo(b)fluoranthene	5,000	U
n-nitrosodiphenylamine[1]	5,000	U	benzo(k)fluoranthene	5,000	U
4-bromophenyl-phenylether	5,000	U	benzo(a)pyrene	5,000	U
hexachlorobenzene	5,000	U	indeno(1,2,3-cd)pyrene	5,000	U
pentachlorophenol	24,000	U	dibenzo(a,h)anthracene	5,000	U
phenanthrene	5,000	U	benzo(g,h,i)perylene	5,000	U

This method blank applies to samples Influent Feed 3/24/93 R and Rx 4/1/93 RE.

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
1 - Cannot be separated from diphenylamine.

Date of Extraction: 04/23/93
Date of Analysis: 04/27/93

ADDITIONAL SEMIVOLATILE ORGANIC ANALYSIS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank 2
Lab Sample ID: H3834

Tentative Identification (1)	Concentration (2)
butanoic acid, 4-chloro-	2,400

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

	SEMIVOLATILE					
Client Sample ID	Nitro-Benzene-D5 (23-120%)*	2-Fluoro-Biphenyl (30-115%)*	Terphenyl-D14 (18-137%)*	Phenol-D5 (24-113%)*	2-Fluoro-Phenol (25-121%)*	2,4,6-Tribromo-Phenol (19-122%)*
Influent Feed 3/26/93	0**	0**	0**	35	28	0**
Rx 4/1/93	0**	0**	0**	0**	0**	0**
Method Blank 1	80	65	85	76	70	45

*Values in parenthesis represent contract required QC limits.
**Values are outside of contract required QC limits.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

	SEMIVOLATILE					
Client Sample ID	Nitro-Benzene-D5 (23-120%)*	2-Fluoro-Biphenyl (30-115%)*	Terphenyl-D14 (18-137%)*	Phenol-D5 (24-113%)*	2-Fluoro-Phenol (25-121%)*	2,4,6-Tribromo-Phenol (19-122%)*
Influent Feed 3/26/93 R	40	56	54	48	42	32
Rx 4/1/93RE	34	49	46	44	36	22
Method Blank 2	56	60	83	60	48	51

*Values in parenthesis represent contract required QC limits.

IT Corporation
April 30, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 53741

HALOGENATED VOLATILE ORGANIC ANALYSIS
Results in µg/kg (ppb)
Sample Matrix: Soil

Client Sample ID: Rx 4/1/93
Lab Sample ID: VV9652

Compound	Concentration		Compound	Concentration	
dichlorodifluoromethane	1.8	U	2-chloroethylvinyl ether	1.3	U
chloromethane	0.8	U	cis-1,3-dichloropropene	3.4	U
vinyl chloride	1.8	U	trans-1,3-dichloropropene	3.4	U
bromomethane	1.2	U	1,1,2-trichloroethane	0.2	U
chloroethane	5.2	U	tetrachloroethene	0.3	U
trichlorofluoromethane	2.0	U	dibromochloromethane	0.9	U
1,1-dichloroethene	1.3	U	n-hexyl chloride	1.0	U
methylene chloride	15	U	chlorobenzene	2.0	U
trans-1,2-dichloroethene	1.0	U	1,1,1,2-tetrachloroethane	0.3	U
1,1-dichloroethane	0.7	U	bromoform	2.0	U
cis-1,2-dichloroethene	1.0	U	1,1,2,2-tetrachloroethane	0.3	U
trichloromethane (chloroform)	0.5	U	1,2,3-trichloropropane	1.0	U
1,1,1-trichloroethane	0.3	U	phenyl bromide (bromobenzene)	2.0	U
carbon tetrachloride	1.2	U	2-chlorotoluene	1.0	U
1,2-dichloroethane	0.3	U	1,3-dichlorobenzene	3.2	U
trichloroethene	1.2	U	1,4-dichlorobenzene	2.4	U
1,2-dichloropropane	0.4	U	1,2-dichlorobenzene	1.5	U
bromodichloromethane	1.0	U	bis (2-chloroisopropyl) ether	20	U
dibromomethane	2.0	U			

Date of Analysis: 04/12/93

U – Compound was analyzed for but not detected. The number is the detection limit for the sample.

HALOGENATED VOLATILE ORGANIC ANALYSIS

Results in µg/kg (ppb)
Sample Matrix: Soil

Client Sample ID: Influent Feed 3/26/93
Lab Sample ID: VV9653

Compound	Concentration		Compound	Concentration	
dichlorodifluoromethane	1.8	U	2-chloroethylvinyl ether	1.3	U
chloromethane	0.8	U	cis-1,3-dichloropropene	3.4	U
vinyl chloride	1.8	U	trans-1,3-dichloropropene	3.4	U
bromomethane	1.2	U	1,1,2-trichloroethane	0.2	U
chloroethane	5.2	U	tetrachloroethene	0.3	U
trichlorofluoromethane	2.0	U	dibromochloromethane	0.9	U
1,1-dichloroethene	1.3	U	n-hexyl chloride	1.0	U
methylene chloride	15	U	chlorobenzene	2.0	U
trans-1,2-dichloroethene	1.0	U	1,1,1,2-tetrachloroethane	0.3	U
1,1-dichloroethane	0.7	U	bromoform	2.0	U
cis-1,2-dichloroethene	1.0	U	1,1,2,2-tetrachloroethane	0.3	U
trichloromethane (chloroform)	0.5	U	1,2,3-trichloropropane	1.0	U
1,1,1-trichloroethane	0.3	U	phenyl bromide (bromobenzene)	2.0	U
carbon tetrachloride	1.2	U	2-chlorotoluene	1.0	U
1,2-dichloroethane	0.3	U	1,3-dichlorobenzene	3.2	U
trichloroethene	1.2	U	1,4-dichlorobenzene	2.4	U
1,2-dichloropropane	0.4	U	1,2-dichlorobenzene	1.5	U
bromodichloromethane	1.0	U	bis (2-chloroisopropyl) ether	20	U
dibromomethane	2.0	U			

Date of Analysis: 04/15/93

U – Compound was analyzed for but not detected. The number is the detection limit for the sample.

HALOGENATED VOLATILE ORGANIC ANALYSIS

Results in µg/kg (ppb)
Sample Matrix: Soil

Client Sample ID: Method Blank 1
Lab Sample ID: B2954

Compound	Concentration	Compound	Concentration
dichlorodifluoromethane	1.8 U	2-chloroethylvinyl ether	1.3 U
chloromethane	0.8 U	cis-1,3-dichloropropene	3.4 U
vinyl chloride	1.8 U	toluene	2.0 U
bromomethane	1.2 U	trans-1,3-dichloropropene	3.4 U
chloroethane	5.2 U	1,1,2-trichloroethane	0.2 U
trichlorofluoromethane	2.0 U	tetrachloroethene	0.3 U
1,1-dichloroethene	1.3 U	dibromochloromethane	0.9 U
methylene chloride	15 U	n-hexyl chloride	1.0 U
trans-1,2-dichloroethene	1.0 U	chlorobenzene	2.0 U
1,1-dichloroethane	0.7 U	ethyl benzene	2.0 U
cis-1,2-dichloroethene	1.0 U	1,1,1,2-tetrachloroethane	0.3 U
trichloromethane (chloroform)	0.5 U	xylenes (total)	1.0 U
1,1,1-trichloroethane	0.9	bromoform	2.0 U
carbon tetrachloride	1.2 U	1,1,2,2-tetrachloroethane	0.3 U
benzene	2.0 U	1,2,3-trichloropropane	1.0 U
1,2-dichloroethane	0.3 U	phenyl bromide (bromobenzene)	2.0 U
trichloroethene	1.2 U	2-chlorotoluene	1.0 U
1,2-dichloropropane	0.4 U	1,3-dichlorobenzene	3.2 U
bromodichloromethane	1.0 U	1,4-dichlorobenzene	2.4 U
dibromomethane	2.0 U	1,2-dichlorobenzene	1.5 U
		bis (2-chloroisopropyl) ether	20 U

Date of Analysis: 04/11/93

U – Compound was analyzed for but not detected. The number is the detection limit for the sample.

This method blank applies to the following sample: Rx 4/1/93.

HALOGENATED AND AROMATIC VOLATILE ORGANIC ANALYSIS

Results in µg/kg (ppb)
Sample Matrix: Soil

Client Sample ID: Method Blank 2
Lab Sample ID: B2965

Compound	Concentration	Compound	Concentration
dichlorodifluoromethane	1.8 U	2-chloroethylvinyl ether	1.3 U
chloromethane	0.8 U	cis-1,3-dichloropropene	3.4 U
vinyl chloride	1.8 U	toluene	2.0 U
bromomethane	1.2 U	trans-1,3-dichloropropene	3.4 U
chloroethane	5.2 U	1,1,2-trichloroethane	0.2 U
trichlorofluoromethane	2.0 U	tetrachloroethene	0.3 U
1,1-dichloroethene	1.3 U	dibromochloromethane	0.9 U
methylene chloride	15 U	n-hexyl chloride	1.0 U
trans-1,2-dichloroethene	1.0 U	chlorobenzene	2.0 U
1,1-dichloroethane	0.7 U	ethyl benzene	2.0 U
cis-1,2-dichloroethene	1.0 U	1,1,1,2-tetrachloroethane	0.3 U
trichloromethane (chloroform)	0.5 U	xylenes (total)	1.0 U
1,1,1-trichloroethane	0.3 U	bromoform	2.0 U
carbon tetrachloride	1.2 U	1,1,2,2-tetrachloroethane	0.3 U
benzene	2.0 U	1,2,3-trichloropropane	1.0 U
1,2-dichloroethane	0.3 U	phenyl bromide (bromobenzene)	2.0 U
trichloroethene	1.2 U	2-chlorotoluene	1.0 U
1,2-dichloropropane	0.4 U	1,3-dichlorobenzene	3.2 U
bromodichloromethane	1.0 U	1,4-dichlorobenzene	2.4 U
dibromomethane	2.0 U	1,2-dichlorobenzene	1.5 U
		bis (2-chloroisopropyl) ether	20 U

Date of Analysis: 04/15/93

U – Compound was analyzed for but not detected. The number is the detection limit for the sample.

This method blank applies to the following sample: Influent Feed 3/26/93.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

		VOLATILE	
Client Sample ID	Lab Sample ID	BCM	OCFB
Rx 4/1/93	VV9652	48	19 *
Influent Feed 3/26/93	VV9653	48	22 *
Method Blank 1	B2954	113 *	94
Method Blank 2	B2965	68	82

	QC LIMITS
BCM - bromochloromethane	(31-112%)
OCFB - ortho-chlorofluorobenzene	(31-113%)

*Value is outside QC limits.

EPA Method 8240

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

April 29, 1993

Job Number: ITDK 53813

P.O. Number: 580000.045

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston
Date Received by Lab:	04/09/93
Number of Samples:	Three (3)
Sample Type:	Slurry

I. Introduction

On 04/09/93, three (3) slurry samples arrived at the ITAS-Knoxville, Tennessee, laboratory from IT Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The samples were analyzed for volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8240.

Reviewed and Approved:

Alyce R. Moore
Laboratory Manager

III. Quality Control

Routine laboratory level I QC was followed.

The volatiles analyses were performed by purge and trap with a J&W DB-624 megabore column on a Finnigan OWA GC/MS/DS unit. The sample analyses generally went well. The initially requested analysis was 8270. Analysis was changed to 8240 per Kandi Brown on 04/16/93. The samples were analyzed as soils. There were variant surrogate recoveries for the analyses of DRUM #3. This was attributed to the matrix of this sample. The continuing calibration standard was noncompliant for ethyl benzene; however, this parameter was not seen in any of the samples. There were no other problems seen in final data review.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Drum 1
Lab Sample ID: XX1004

Compound	Concentration		Compound	Concentration	
chloromethane	18	U	1,2-dichloropropane	9	U
bromomethane	18	U	cis-1,3-dichloropropene	9	U
vinyl chloride	18	U	trichloroethene	9	U
chloroethane	18	U	dibromochloromethane	9	U
methylene chloride	27	B	1,1,2-trichloroethane	9	U
acetone	14	J	benzene	9	U
carbon disulfide	9	U	trans-1,3-dichloropropene	9	U
1,1-dichloroethene	9	U	bromoform	9	U
1,1-dichloroethane	9	U	4-methyl-2-pentanone	18	U
1,2-dichloroethene (total)	9	U	2-hexanone	18	U
chloroform	9	U	tetrachloroethene	9	U
1,2-dichloroethane	9	U	1,1,2,2-tetrachloroethane	9	U
2-butanone	18	U	toluene	9	U
1,1,1-trichloroethane	9	U	chlorobenzene	9	U
carbon tetrachloride	9	U	ethylbenzene	9	U
vinyl acetate	18	U	styrene	9	U
bromodichloromethane	9	U	xylenes (total)	9	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/22/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Drum 1
Lab Sample ID: XX1004

Tentative Identification (1)	Concentration (2)
None detected	

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Drum 3
Lab Sample ID: XX1005

Compound	Concentration		Compound	Concentration	
chloromethane	18	U	1,2-dichloropropane	9	U
bromomethane	18	U	cis-1,3-dichloropropene	9	U
vinyl chloride	18	U	trichloroethene	9	U
chloroethane	18	U	dibromochloromethane	9	U
methylene chloride	26	B	1,1,2-trichloroethane	9	U
acetone	25		benzene	9	U
carbon disulfide	9	U	trans-1,3-dichloropropene	9	U
1,1-dichloroethene	9	U	bromoform	9	U
1,1-dichloroethane	9	U	4-methyl-2-pentanone	18	U
1,2-dichloroethene (total)	9	U	2-hexanone	18	U
chloroform	9	U	tetrachloroethene	9	U
1,2-dichloroethane	9	U	1,1,2,2-tetrachloroethane	9	U
2-butanone	18	U	toluene	9	U
1,1,1-trichloroethane	9	U	chlorobenzene	9	U
carbon tetrachloride	9	U	ethylbenzene	9	U
vinyl acetate	18	U	styrene	9	U
bromodichloromethane	9	U	xylenes (total)	9	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/22/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Drum 3
Lab Sample ID: XX1005

Tentative Identification (1)	Concentration (2)
None detected	

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Drum 6
Lab Sample ID: XX1006

Compound	Concentration	Compound	Concentration
chloromethane	17 U	1,2-dichloropropane	8 U
bromomethane	17 U	cis-1,3-dichloropropene	8 U
vinyl chloride	17 U	trichloroethene	8 U
chloroethane	17 U	dibromochloromethane	8 U
methylene chloride	20 B	1,1,2-trichloroethane	8 U
acetone	26	benzene	8 U
carbon disulfide	8 U	trans-1,3-dichloropropene	8 U
1,1-dichloroethene	8 U	bromoform	8 U
1,1-dichloroethane	8 U	4-methyl-2-pentanone	17 U
1,2-dichloroethene (total)	8 U	2-hexanone	17 U
chloroform	8 U	tetrachloroethene	8 U
1,2-dichloroethane	8 U	1,1,2,2-tetrachloroethane	8 U
2-butanone	17 U	toluene	8 U
1,1,1-trichloroethane	8 U	chlorobenzene	8 U
carbon tetrachloride	8 U	ethylbenzene	8 U
vinyl acetate	17 U	styrene	8 U
bromodichloromethane	8 U	xylenes (total)	8 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/22/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Drum 6
Lab Sample ID: XX1006

Tentative Identification (1)	Concentration (2)
None detected	

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB04223

Compound	Concentration		Compound	Concentration	
chloromethane	10	U	1,2-dichloropropane	5	U
bromomethane	10	U	cis-1,3-dichloropropene	5	U
vinyl chloride	10	U	trichloroethene	5	U
chloroethane	10	U	dibromochloromethane	5	U
methylene chloride	3	J	1,1,2-trichloroethane	5	U
acetone	10	U	benzene	5	U
carbon disulfide	5	U	trans-1,3-dichloropropene	5	U
1,1-dichloroethene	5	U	bromoform	5	U
1,1-dichloroethane	5	U	4-methyl-2-pentanone	10	U
1,2-dichloroethene (total)	5	U	2-hexanone	10	U
chloroform	5	U	tetrachloroethene	5	U
1,2-dichloroethane	5	U	1,1,2,2-tetrachloroethane	5	U
2-butanone	10	U	toluene	5	U
1,1,1-trichloroethane	5	U	chlorobenzene	5	U
carbon tetrachloride	5	U	ethylbenzene	5	U
vinyl acetate	10	U	styrene	5	U
bromodichloromethane	5	U	xylenes (total)	5	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 04/22/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB04223

Tentative Identification (1)	Concentration (2)
None detected	

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

	VOLATILE		
Client Sample ID	Toluene-D8 (81-117%)*	BFB (74-121%)*	1,2 Dichloroethane-D4 (70-121%)*
Drum 1	116	76	95
Drum 3	125 **	74	97
Drum 6	112	74	92
Method Blank	97	95	96

* - Values in parenthesis represent QC limits.
** - Values are outside QC limits.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

May 3, 1993

Job Number: ITDK 53867

P.O. Number: 580000.045

This is the Certificate of Analysis for the following sample:

Client Project ID:	Weston
Date Received by Lab:	04/16/93
Number of Samples:	One (1)
Sample Type:	Slurry

I. Introduction

On 04/16/93, one (1) slurry sample arrived at the ITAS-Knoxville, Tennessee, laboratory from IT-Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The sample was analyzed for volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8240.

Reviewed and Approved:

Alyce R. Moore

Alyce R. Moore
Laboratory Manager

III. Quality Control

Routine laboratory level I QC was followed.

The volatiles analyses were performed by purge and trap with a J&W DB-624 megabore column on a Finnigan OWA GC/MS/DS unit. The sample analyses generally went well, although some difficulties were encountered related to sample matrix. Toluene-d8 and bromofluorobenzene surrogate recoveries were outside method limits in the sample analyses. This was confirmed as a matrix phenomenon by reanalysis. The two analyses were in good agreement. There were no other problems seen in final data review.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY
Lab Sample ID: XX1784

Compound	Concentration		Compound	Concentration	
chloromethane	37	U	1,2-dichloropropane	19	U
bromomethane	37	U	cis-1,3-dichloropropene	19	U
vinyl chloride	37	U	trichloroethene	19	U
chloroethane	37	U	dibromochloromethane	19	U
methylene chloride	23	B	1,1,2-trichloroethane	19	U
acetone	110		benzene	19	U
carbon disulfide	7	J	trans-1,3-dichloropropene	19	U
1,1-dichloroethene	19	U	bromoform	19	U
1,1-dichloroethane	19	U	4-methyl-2-pentanone	37	U
1,2-dichloroethene (total)	19	U	2-hexanone	37	U
chloroform	19	U	tetrachloroethene	19	U
1,2-dichloroethane	19	U	1,1,2,2-tetrachloroethane	19	U
2-butanone	14	J	toluene	19	U
1,1,1-trichloroethane	19	U	chlorobenzene	19	U
carbon tetrachloride	19	U	ethylbenzene	19	U
vinyl acetate	37	U	styrene	19	U
bromodichloromethane	19	U	xylenes (total)	19	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/23/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY
Lab Sample ID: XX1784

Tentative Identification (1)	Concentration (2)
cyclohexanone (ACN)	54

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

IT Corporation
May 3, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 53867

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY RE
Lab Sample ID: XX1784

Compound	Concentration		Compound	Concentration	
chloromethane	37	U	1,2-dichloropropane	19	U
bromomethane	37	U	cis-1,3-dichloropropene	19	U
vinyl chloride	37	U	trichloroethene	19	U
chloroethane	37	U	dibromochloromethane	19	U
methylene chloride	21	B	1,1,2-trichloroethane	19	U
acetone	110		benzene	19	U
carbon disulfide	6	J	trans-1,3-dichloropropene	19	U
1,1-dichloroethene	19	U	bromoform	19	U
1,1-dichloroethane	19	U	4-methyl-2-pentanone	37	U
1,2-dichloroethene (total)	19	U	2-hexanone	37	U
chloroform	19	U	tetrachloroethene	19	U
1,2-dichloroethane	19	U	1,1,2,2-tetrachloroethane	19	U
2-butanone	19	J	toluene	19	U
1,1,1-trichloroethane	19	U	chlorobenzene	19	U
carbon tetrachloride	19	U	ethylbenzene	19	U
vinyl acetate	37	U	styrene	19	U
bromodichloromethane	19	U	xylenes (total)	19	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/24/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY RE
Lab Sample ID: XX1784

Tentative Identification (1)	Concentration (2)
cyclohexanone (ACN)	73

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

IT Corporation
May 3, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 53867

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB04232

Compound	Concentration		Compound	Concentration	
chloromethane	10	U	1,2-dichloropropane	5	U
bromomethane	10	U	cis-1,3-dichloropropene	5	U
vinyl chloride	10	U	trichloroethene	5	U
chloroethane	10	U	dibromochloromethane	5	U
methylene chloride	2	J	1,1,2-trichloroethane	5	U
acetone	10	U	benzene	5	U
carbon disulfide	5	U	trans-1,3-dichloropropene	5	U
1,1-dichloroethene	5	U	bromoform	5	U
1,1-dichloroethane	5	U	4-methyl-2-pentanone	10	U
1,2-dichloroethene (total)	5	U	2-hexanone	10	U
chloroform	5	U	tetrachloroethene	5	U
1,2-dichloroethane	5	U	1,1,2,2-tetrachloroethane	5	U
2-butanone	10	U	toluene	5	U
1,1,1-trichloroethane	5	U	chlorobenzene	5	U
carbon tetrachloride	5	U	ethylbenzene	5	U
vinyl acetate	10	U	styrene	5	U
bromodichloromethane	5	U	xylenes (total)	5	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 04/23/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB04232

Tentative Identification (1)	Concentration (2)
None detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

	VOLATILE		
Client Sample ID	Toluene-D8 (81-117%)*	BFB (74-121%)*	1,2 Dichloroethane-D4 (70-121%)*
Rx SLURRY	139 **	60 **	90
Rx SLURRY RE	130 **	64 **	86
Method Blank	94	93	90

* - Values in parentheses represent QC limits.
** - Values are outside QC limits.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

May 3, 1993

Job Number: ITDK 53880

P.O. Number: 580000.045

This is the Certificate of Analysis for the following sample:

Client Project ID:	Weston
Date Received by Lab:	04/19/93
Number of Samples:	One (1)
Sample Type:	Slurry

I. Introduction

On 04/19/93, one (1) slurry sample arrived at the ITAS-Knoxville, Tennessee, laboratory from IT-Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The sample was analyzed for volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8240.

Reviewed and Approved:

Alyce R. Moore
Laboratory Manager

III. Quality Control

Routine laboratory level I QC was followed.

The volatiles analyses were performed by purge and trap with a J&W DB-624 megabore column on a Finnigan OWA GC/MS/DS unit. The sample analyses generally went well, although some difficulties were encountered related to sample matrix. Toluene-d8 and bromofluorobenzene surrogate recoveries were outside method limits in the original sample analysis. Analysis of a dilution exhibited compliant surrogate recoveries. The original analysis was included for comparison. There were no other problems seen in final data review.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: 4/19/93 Rx
Lab Sample ID: XX1952

Compound	Concentration		Compound	Concentration	
chloromethane	31	U	1,2-dichloropropane	16	U
bromomethane	31	U	cis-1,3-dichloropropene	16	U
vinyl chloride	31	U	trichloroethene	16	U
chloroethane	31	U	dibromochloromethane	16	U
methylene chloride	15	BJ	1,1,2-trichloroethane	16	U
acetone	97	B	benzene	16	U
carbon disulfide	16	U	trans-1,3-dichloropropene	16	U
1,1-dichloroethene	16	U	bromoform	16	U
1,1-dichloroethane	16	U	4-methyl-2-pentanone	31	U
1,2-dichloroethene (total)	16	U	2-hexanone	31	U
chloroform	16	U	tetrachloroethene	16	U
1,2-dichloroethane	16	U	1,1,2,2-tetrachloroethane	16	U
2-butanone	14	J	toluene	16	U
1,1,1-trichloroethane	16	U	chlorobenzene	16	U
carbon tetrachloride	16	U	ethylbenzene	16	U
vinyl acetate	31	U	styrene	16	U
bromodichloromethane	16	U	xylenes (total)	16	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/22/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: 4/19/93 Rx
Lab Sample ID: XX1952

Tentative Identification (1)	Concentration (2)
cyclohexanone (ACN)	26

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: 4/19/93 Rx DL
Lab Sample ID: XX1952

Compound	Concentration		Compound	Concentration	
chloromethane	160	U	1,2-dichloropropane	78	U
bromomethane	160	U	cis-1,3-dichloropropene	78	U
vinyl chloride	160	U	trichloroethene	78	U
chloroethane	160	U	dibromochloromethane	78	U
methylene chloride	67	BDJ	1,1,2-trichloroethane	78	U
acetone	120	BDJ	benzene	78	U
carbon disulfide	78	U	trans-1,3-dichloropropene	78	U
1,1-dichloroethene	78	U	bromoform	78	U
1,1-dichloroethane	78	U	4-methyl-2-pentanone	160	U
1,2-dichloroethene (total)	78	U	2-hexanone	160	U
chloroform	78	U	tetrachloroethene	78	U
1,2-dichloroethane	78	U	1,1,2,2-tetrachloroethane	78	U
2-butanone	160	U	toluene	78	U
1,1,1-trichloroethane	78	U	chlorobenzene	78	U
carbon tetrachloride	78	U	ethylbenzene	78	U
vinyl acetate	160	U	styrene	78	U
bromodichloromethane	78	U	xylenes (total)	78	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.
D - Compound analyzed at a secondary dilution factor.

Date of Analysis: 04/22/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: 4/19/93 Rx DL
Lab Sample ID: XX1952

Tentative Identification (1)	Concentration (2)
None Detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB04212

Compound	Concentration		Compound	Concentration	
chloromethane	10	U	1,2-dichloropropane	5	U
bromomethane	10	U	cis-1,3-dichloropropene	5	U
vinyl chloride	10	U	trichloroethene	5	U
chloroethane	10	U	dibromochloromethane	5	U
methylene chloride	2	J	1,1,2-trichloroethane	5	U
acetone	3	J	benzene	5	U
carbon disulfide	5	U	trans-1,3-dichloropropene	5	U
1,1-dichloroethene	5	U	bromoform	5	U
1,1-dichloroethane	5	U	4-methyl-2-pentanone	10	U
1,2-dichloroethene (total)	5	U	2-hexanone	10	U
chloroform	5	U	tetrachloroethene	5	U
1,2-dichloroethane	5	U	1,1,2,2-tetrachloroethane	5	U
2-butanone	10	U	toluene	5	U
1,1,1-trichloroethane	5	U	chlorobenzene	5	U
carbon tetrachloride	5	U	ethylbenzene	5	U
vinyl acetate	10	U	styrene	5	U
bromodichloromethane	5	U	xylenes (total)	5	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 04/21/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB04212

Tentative Identification (1)	Concentration (2)
None detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

VOLATILE

Client Sample ID	Toluene-D8 (81-117%)*	BFB (74-121%)*	1,2 Dichloroethane-D4 (70-121%)*
4/19/93 Rx	123 **	61 **	86
4/19/93 Rx DL	109	91	97
Method Blank	102	102	96

* - Values in parentheses represent QC limits.
** - Values are outside QC limits.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

May 3, 1993

Job Number: ITDK 53802

P.O. Number: 4084900.330

This is the Certificate of Analysis for the following sample:

Client Project ID:	Weston
Date Received by Lab:	04/08/93
Number of Samples:	One (1)
Sample Type:	Slurry

I. Introduction

On 04/08/93, one (1) slurry sample arrived at the ITAS-Knoxville, Tennessee, laboratory from IT Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The sample was analyzed for volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8240.

Reviewed and Approved:

Alyce R. Moore
Laboratory Manager

III. Quality Control

Routine laboratory level I QC was followed.

The volatiles analyses were performed by purge and trap with a J&W DB-624 megabore column on a Finnigan OWA GC/MS/DS. Analysis was originally requested as 8270. This was changed to 8240 per Kandi Brown on 04/16/93. The sample analyses went well. Two surrogate spikes, toluene-d8 and bromofluorobenzene, were outside method limits in the original analysis of Rx 4/8/93. This was confirmed as an effect of matrix by reanalysis. This result was consistent with the appearance of the slurry. Both sets of samples were submitted for comparison. There were no problems seen in final data review.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx 4/8/93
Lab Sample ID: XX0876

Compound	Concentration		Compound	Concentration	
chloromethane	43	U	1,2-dichloropropane	22	U
bromomethane	43	U	cis-1,3-dichloropropene	22	U
vinyl chloride	43	U	trichloroethene	22	U
chloroethane	43	U	dibromochloromethane	22	U
methylene chloride	51	B	1,1,2-trichloroethane	22	U
acetone	140		benzene	22	U
carbon disulfide	10	J	trans-1,3-dichloropropene	22	U
1,1-dichloroethene	22	U	bromoform	22	U
1,1-dichloroethane	22	U	4-methyl-2-pentanone	43	U
1,2-dichloroethene (total)	22	U	2-hexanone	43	U
chloroform	22	U	tetrachloroethene	22	U
1,2-dichloroethane	22	U	1,1,2,2-tetrachloroethane	22	U
2-butanone	7	J	toluene	22	U
1,1,1-trichloroethane	22	U	chlorobenzene	22	U
carbon tetrachloride	22	U	ethylbenzene	22	U
vinyl acetate	43	U	styrene	22	U
bromodichloromethane	22	U	xylenes (total)	22	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/23/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx 4/8/93
Lab Sample ID: XX0876

Tentative Identification (1)	Concentration (2)
None detected	

Remarks (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx 4/8/93RE
Lab Sample ID: XX0876

Compound	Concentration		Compound	Concentration	
chloromethane	43	U	1,2-dichloropropane	22	U
bromomethane	43	U	cis-1,3-dichloropropene	22	U
vinyl chloride	43	U	trichloroethene	22	U
chloroethane	43	U	dibromochloromethane	22	U
methylene chloride	54	B	1,1,2-trichloroethane	22	U
acetone	120		benzene	22	U
carbon disulfide	10	J	trans-1,3-dichloropropene	22	U
1,1-dichloroethene	22	U	bromoform	22	U
1,1-dichloroethane	22	U	4-methyl-2-pentanone	43	U
1,2-dichloroethene (total)	22	U	2-hexanone	43	U
chloroform	22	U	tetrachloroethene	22	U
1,2-dichloroethane	22	U	1,1,2,2-tetrachloroethane	22	U
2-butanone	7	J	toluene	22	U
1,1,1-trichloroethane	22	U	chlorobenzene	22	U
carbon tetrachloride	22	U	ethylbenzene	22	U
vinyl acetate	43	U	styrene	22	U
bromodichloromethane	22	U	xylenes (total)	22	U

J - Indicates an estimated value less than the detection limit.
U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/23/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx 4/8/93RE
Lab Sample ID: XX0876

Tentative Identification (1)	Concentration (2)
None detected	

Remarks (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB04223

Compound	Concentration	Compound	Concentration
chloromethane	10 U	1,2-dichloropropane	5 U
bromomethane	10 U	cis-1,3-dichloropropene	5 U
vinyl chloride	10 U	trichloroethene	5 U
chloroethane	10 U	dibromochloromethane	5 U
methylene chloride	3 J	1,1,2-trichloroethane	5 U
acetone	10 U	benzene	5 U
carbon disulfide	5 U	trans-1,3-dichloropropene	5 U
1,1-dichloroethene	5 U	bromoform	5 U
1,1-dichloroethane	5 U	4-methyl-2-pentanone	10 U
1,2-dichloroethene (total)	5 U	2-hexanone	10 U
chloroform	5 U	tetrachloroethene	5 U
1,2-dichloroethane	5 U	1,1,2,2-tetrachloroethane	5 U
2-butanone	10 U	toluene	5 U
1,1,1-trichloroethane	5 U	chlorobenzene	5 U
carbon tetrachloride	5 U	ethylbenzene	5 U
vinyl acetate	10 U	styrene	5 U
bromodichloromethane	5 U	xylenes (total)	5 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 04/22/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB04223

Tentative Identification (1)	Concentration (2)
None detected	

Remarks (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

	VOLATILE		
Client Sample ID	Toluene-D8 (81-117%)*	BFB (74-121%)*	1,2 Dichloroethane-D4 (70-121%)*
Rx 4/8/93	123 **	58 **	92
Rx 4/8/93RE	114	60 **	89
Method Blank	97	95	96

* - Values in parenthesis represent QC limits.
** - Values are outside QC limits.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

May 3, 1993

Job Number: ITDK 53775

P.O. Number: 580000.045

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston
Date Received by Lab:	04/05/93
Number of Samples:	Two (2)
Sample Type:	Slurry

I. Introduction

On 04/05/93, two (2) slurry samples arrived at the ITAS-Knoxville, Tennessee, laboratory from IT-Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The samples were analyzed for volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8240.

Reviewed and Approved:

Alyce R. Moore
Laboratory Manager

III. Quality Control

Routine laboratory level I QC was followed.

The volatiles analyses were performed by purge and trap with a J&W DB-624 megabore column on a Finnigan OWA GC/MS/DS unit. The sample analyses went well. The samples were originally coded for 8270 and were extracted. The analysis was changed to 8240 per Kandi Brown on 04/16/93. This resulted in a shortage of sample, hence, only one gram portions of Rx 4/2/93 and Rx 4/5/93 were analyzed. There were no problems seen in final data review.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx 4/2/93
Lab Sample ID: XX0337

Compound	Concentration	Compound	Concentration
chloromethane	110 U	1,2-dichloropropane	54 U
bromomethane	110 U	cis-1,3-dichloropropene	54 U
vinyl chloride	110 U	trichloroethene	54 U
chloroethane	110 U	dibromochloromethane	54 U
methylene chloride	520 B	1,1,2-trichloroethane	54 U
acetone	330	benzene	54 U
carbon disulfide	54 U	trans-1,3-dichloropropene	54 U
1,1-dichloroethene	54 U	bromoform	54 U
1,1-dichloroethane	54 U	4-methyl-2-pentanone	110 U
1,2-dichloroethene (total)	54 U	2-hexanone	110 U
chloroform	54 U	tetrachloroethene	54 U
1,2-dichloroethane	54 U	1,1,2,2-tetrachloroethane	54 U
2-butanone	110 U	toluene	54 U
1,1,1-trichloroethane	54 U	chlorobenzene	54 U
carbon tetrachloride	54 U	ethylbenzene	54 U
vinyl acetate	110 U	styrene	54 U
bromodichloromethane	54 U	xylenes (total)	54 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/16/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx 4/2/93
Lab Sample ID: XX0337

Tentative Identification (1)	Concentration (2)
None detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx 4/5/93
Lab Sample ID: XX0338

Compound	Concentration		Compound	Concentration	
chloromethane	110	U	1,2-dichloropropane	56	U
bromomethane	110	U	cis-1,3-dichloropropene	56	U
vinyl chloride	110	U	trichloroethene	56	U
chloroethane	110	U	dibromochloromethane	56	U
methylene chloride	460	B	1,1,2-trichloroethane	56	U
acetone	750		benzene	56	U
carbon disulfide	56	U	trans-1,3-dichloropropene	56	U
1,1-dichloroethene	56	U	bromoform	56	U
1,1-dichloroethane	56	U	4-methyl-2-pentanone	110	U
1,2-dichloroethene (total)	56	U	2-hexanone	110	U
chloroform	56	U	tetrachloroethene	56	U
1,2-dichloroethane	56	U	1,1,2,2-tetrachloroethane	56	U
2-butanone	15	J	toluene	56	U
1,1,1-trichloroethane	56	U	chlorobenzene	56	U
carbon tetrachloride	56	U	ethylbenzene	56	U
vinyl acetate	110	U	styrene	56	U
bromodichloromethane	56	U	xylenes (total)	56	U

J - Indicates an estimated value less than the detection limit.
U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/16/93

IT Corporation
May 3, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 53775

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx 4/5/93
Lab Sample ID: XX0338

Tentative Identification (1)	Concentration (2)
None detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: EB0416

Compound	Concentration	Compound	Concentration
chloromethane	10 U	1,2-dichloropropane	5 U
bromomethane	10 U	cis-1,3-dichloropropene	5 U
vinyl chloride	10 U	trichloroethene	5 U
chloroethane	10 U	dibromochloromethane	5 U
methylene chloride	4 J	1,1,2-trichloroethane	5 U
acetone	10 U	benzene	5 U
carbon disulfide	5 U	trans-1,3-dichloropropene	5 U
1,1-dichloroethene	5 U	bromoform	5 U
1,1-dichloroethane	5 U	4-methyl-2-pentanone	10 U
1,2-dichloroethene (total)	5 U	2-hexanone	10 U
chloroform	5 U	tetrachloroethene	5 U
1,2-dichloroethane	5 U	1,1,2,2-tetrachloroethane	5 U
2-butanone	10 U	toluene	5 U
1,1,1-trichloroethane	5 U	chlorobenzene	5 U
carbon tetrachloride	5 U	ethylbenzene	5 U
vinyl acetate	10 U	styrene	5 U
bromodichloromethane	5 U	xylenes (total)	5 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 04/16/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: EB0416

Tentative Identification (1)	Concentration (2)
None detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

	VOLATILE		
Client Sample ID	Toluene-D8 (81-117%)*	BFB (74-121%)*	1,2 Dichloroethane-D4 (70-121%)*
Rx 4/2/93	102	92	71
Rx 4/5/93	108	87	71
Method Blank	94	97	81

* - Values in parentheses represent QC limits.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

May 5, 1993

Job Number: ITDK 53839

P.O. Number: 580000.045

This is the Certificate of Analysis for the following sample:

Client Project ID:	Weston
Date Received by Lab:	04/13/93
Number of Samples:	One (1)
Sample Type:	Slurry

I. Introduction

On 04/13/93, one (1) slurry sample arrived at the ITAS-Knoxville, Tennessee, laboratory from IT-Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The sample was analyzed for volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8240.

Reviewed and Approved:

Alyce R. Moore

Alyce R. Moore
Laboratory Manager

III. Quality Control

Routine laboratory level I QC was followed.

The volatiles analyses were performed by purge and trap with a J&W DB-624 megabore column on a Finnigan OWA GC/MS/DS unit. The original analysis requested was 8270. This was changed to 8240 per Kandi Brown on 04/16/93. The sample analyses generally went well, although some difficulties were encountered related to sample matrix. Toluene-d8 and bromofluorobenzene surrogate recoveries were outside method limits in the sample analyses. This was confirmed as a matrix phenomenon by reanalysis. The two analyses were in good agreement. There were no other problems seen in final data review.

IT Corporation
May 5, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 53839

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY
Lab Sample ID: XX1528

Compound	Concentration		Compound	Concentration	
chloromethane	29	U	1,2-dichloropropane	15	U
bromomethane	29	U	cis-1,3-dichloropropene	15	U
vinyl chloride	29	U	trichloroethene	15	U
chloroethane	29	U	dibromochloromethane	15	U
methylene chloride	32	B	1,1,2-trichloroethane	15	U
acetone	79		benzene	15	U
carbon disulfide	6	J	trans-1,3-dichloropropene	15	U
1,1-dichloroethene	15	U	bromoform	15	U
1,1-dichloroethane	15	U	4-methyl-2-pentanone	29	U
1,2-dichloroethene (total)	15	U	2-hexanone	29	U
chloroform	15	U	tetrachloroethene	15	U
1,2-dichloroethane	15	U	1,1,2,2-tetrachloroethane	15	U
2-butanone	29	U	toluene	15	U
1,1,1-trichloroethane	15	U	chlorobenzene	15	U
carbon tetrachloride	15	U	ethylbenzene	15	U
vinyl acetate	29	U	styrene	15	U
bromodichloromethane	15	U	xylenes (total)	15	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/23/93

IT Corporation
May 5, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 53839

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY
Lab Sample ID: XX1528

Tentative Identification (1)	Concentration (2)
cyclohexanone (ACN)	22

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

IT Corporation
May 5, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 53839

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY RE
Lab Sample ID: XX1528

Compound	Concentration		Compound	Concentration	
chloromethane	29	U	1,2-dichloropropane	15	U
bromomethane	29	U	cis-1,3-dichloropropene	15	U
vinyl chloride	29	U	trichloroethene	15	U
chloroethane	29	U	dibromochloromethane	15	U
methylene chloride	29	B	1,1,2-trichloroethane	15	U
acetone	76		benzene	15	U
carbon disulfide	5	J	trans-1,3-dichloropropene	15	U
1,1-dichloroethene	15	U	bromoform	15	U
1,1-dichloroethane	15	U	4-methyl-2-pentanone	29	U
1,2-dichloroethene (total)	15	U	2-hexanone	29	U
chloroform	15	U	tetrachloroethene	15	U
1,2-dichloroethane	15	U	1,1,2,2-tetrachloroethane	15	U
2-butanone	5	J	toluene	15	U
1,1,1-trichloroethane	15	U	chlorobenzene	15	U
carbon tetrachloride	15	U	ethylbenzene	15	U
vinyl acetate	29	U	styrene	15	U
bromodichloromethane	15	U	xylenes (total)	15	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 04/23/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY RE
Lab Sample ID: XX1528

Tentative Identification (1)	Concentration (2)
cyclohexanone (ACN)	31

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB04223

Compound	Concentration		Compound	Concentration	
chloromethane	10	U	1,2-dichloropropane	5	U
bromomethane	10	U	cis-1,3-dichloropropene	5	U
vinyl chloride	10	U	trichloroethene	5	U
chloroethane	10	U	dibromochloromethane	5	U
methylene chloride	3	J	1,1,2-trichloroethane	5	U
acetone	10	U	benzene	5	U
carbon disulfide	5	U	trans-1,3-dichloropropene	5	U
1,1-dichloroethene	5	U	bromoform	5	U
1,1-dichloroethane	5	U	4-methyl-2-pentanone	10	U
1,2-dichloroethene (total)	5	U	2-hexanone	10	U
chloroform	5	U	tetrachloroethene	5	U
1,2-dichloroethane	5	U	1,1,2,2-tetrachloroethane	5	U
2-butanone	10	U	toluene	5	U
1,1,1-trichloroethane	5	U	chlorobenzene	5	U
carbon tetrachloride	5	U	ethylbenzene	5	U
vinyl acetate	10	U	styrene	5	U
bromodichloromethane	5	U	xylenes (total)	5	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 04/22/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB04223

Tentative Identification (1)	Concentration (2)
None detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

VOLATILE

Client Sample ID	Toluene-D8 (81-117%)*	BFB (74-121%)*	1,2 Dichloroethane-D4 (70-121%)*
Rx SLURRY	120 **	58 **	88
Rx SLURRY RE	109	57 **	87
Method Blank	97	95	96

* - Values in parentheses represent QC limits.
** - Values outside QC limits.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

May 18, 1993

Job Number: ITDK 53911

P.O. Number: 580000.045

This is the Certificate of Analysis for the following sample:

Client Project ID:	Weston
Date Received by Lab:	04/22/93
Number of Samples:	One (1)
Sample Type:	Slurry

I. Introduction

On 04/22/93, one (1) slurry sample arrived at the ITAS-Knoxville, Tennessee, laboratory from IT-Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The sample was analyzed for volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8240.

Reviewed and Approved:

Alyce R. Moore
Laboratory Manager

III. Quality Control

Routine laboratory level I QC was followed.

The volatiles analyses were performed by purge and trap with a J&W DB-624 megabore column on a Finnigan OWA GC/MS/DS unit. The sample analysis went well. The sample exhibited the usual matrix interference resulting in low recoveries of two surrogate spikes. A dilution of the sample lessened the effects of matrix yielding a method compliant analysis, but with elevated detection limits. Both sets of data were included for comparison. There were no problems seen in final data review.

IT Corporation
May 18, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 53911

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY
Lab Sample ID: XX2233

Compound	Concentration		Compound	Concentration	
chloromethane	33	U	1,2-dichloropropane	17	U
bromomethane	33	U	cis-1,3-dichloropropene	17	U
vinyl chloride	33	U	trichloroethene	17	U
chloroethane	33	U	dibromochloromethane	17	U
methylene chloride	14	BJ	1,1,2-trichloroethane	17	U
acetone	170	B	benzene	17	U
carbon disulfide	5	J	trans-1,3-dichloropropene	17	U
1,1-dichloroethene	17	U	bromoform	17	U
1,1-dichloroethane	17	U	4-methyl-2-pentanone	33	U
1,2-dichloroethene (total)	17	U	2-hexanone	33	U
chloroform	17	U	tetrachloroethene	17	U
1,2-dichloroethane	17	U	1,1,2,2-tetrachloroethane	17	U
2-butanone	3	J	toluene	17	U
1,1,1-trichloroethane	17	U	chlorobenzene	17	U
carbon tetrachloride	17	U	ethylbenzene	17	U
vinyl acetate	33	U	styrene	17	U
bromodichloromethane	17	U	xylenes (total)	17	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 05/04/93

IT Corporation
May 18, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 53911

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY
Lab Sample ID: XX2233

Tentative Identification (1)	Concentration (2)
None detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY DL
Lab Sample ID: XX2233

Compound	Concentration		Compound	Concentration	
chloromethane	170	U	1,2-dichloropropane	83	U
bromomethane	170	U	cis-1,3-dichloropropene	83	U
vinyl chloride	170	U	trichloroethene	83	U
chloroethane	170	U	dibromochloromethane	83	U
methylene chloride	52	BDJ	1,1,2-trichloroethane	83	U
acetone	300	BD	benzene	83	U
carbon disulfide	83	U	trans-1,3-dichloropropene	83	U
1,1-dichloroethene	83	U	bromoform	83	U
1,1-dichloroethane	83	U	4-methyl-2-pentanone	170	U
1,2-dichloroethene (total)	83	U	2-hexanone	170	U
chloroform	83	U	tetrachloroethene	83	U
1,2-dichloroethane	83	U	1,1,2,2-tetrachloroethane	83	U
2-butanone	170	U	toluene	83	U
1,1,1-trichloroethane	83	U	chlorobenzene	83	U
carbon tetrachloride	83	U	ethylbenzene	83	U
vinyl acetate	170	U	styrene	83	U
bromodichloromethane	83	U	xylenes (total)	83	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.
D - Surrogates diluted out.

Date of Analysis: 05/04/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY DL
Lab Sample ID: XX2233

Tentative Identification (1)	Concentration (2)
None Detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB05042

Compound	Concentration		Compound	Concentration	
chloromethane	10	U	1,2-dichloropropane	5	U
bromomethane	10	U	cis-1,3-dichloropropene	5	U
vinyl chloride	10	U	trichloroethene	5	U
chloroethane	10	U	dibromochloromethane	5	U
methylene chloride	5		1,1,2-trichloroethane	5	U
acetone	8	J	benzene	5	U
carbon disulfide	5	U	trans-1,3-dichloropropene	5	U
1,1-dichloroethene	5	U	bromoform	5	U
1,1-dichloroethane	5	U	4-methyl-2-pentanone	10	U
1,2-dichloroethene (total)	5	U	2-hexanone	10	U
chloroform	5	U	tetrachloroethene	5	U
1,2-dichloroethane	5	U	1,1,2,2-tetrachloroethane	5	U
2-butanone	10	U	toluene	5	U
1,1,1-trichloroethane	5	U	chlorobenzene	5	U
carbon tetrachloride	5	U	ethylbenzene	5	U
vinyl acetate	10	U	styrene	5	U
bromodichloromethane	5	U	xylenes (total)	5	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 05/04/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB05042

Tentative Identification (1)	Concentration (2)
None detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

	VOLATILE		
Client Sample ID	Toluene-D8 (81-117%)*	BFB (74-121%)*	1,2 Dichloroethane-D4 (70-121%)*
Rx SLURRY	125 **	67 **	83
Rx SLURRY DL	106	91	87
Method Blank	100	98	90

* - Values in parentheses represent QC limits.
** - Values outside QC limits.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

May 25, 1993

Job Number: ITDK 53933

P.O. Number: 580000.045

This is the Certificate of Analysis for the following sample:

Client Project ID:	Weston
Date Received by Lab:	04/26/93
Number of Samples:	One (1)
Sample Type:	Slurry

I. Introduction

On 04/26/93, one (1) slurry sample arrived at the ITAS-Knoxville, Tennessee, laboratory from IT-Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The sample was analyzed for volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8240.

Reviewed and Approved:

Alyce R. Moore
Laboratory Manager

III. Quality Control

Routine laboratory level I QC was followed.

The volatiles analyses were performed by purge and trap with a J&W DB-624 megabore column on a Finnigan OWA GC/MS/DS unit. The sample analysis generally went well. Two surrogates, toluene-d8 and bromofluorobenzene, yielded low recoveries due to matrix interference. The effects of matrix were lessened by diluting the sample five-fold. This resulted in a compliant analysis, but with elevated detection limits. Both sets of data were submitted for comparison. There were no problems seen in final data review.

IT Corporation
May 25, 1993

Client Project ID: Weston

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN
Job Number: ITDK 53933

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Reactor S-2
Lab Sample ID: XX2382

Compound	Concentration		Compound	Concentration	
chloromethane	83	U	1,2-dichloropropane	42	U
bromomethane	83	U	cis-1,3-dichloropropene	42	U
vinyl chloride	83	U	trichloroethene	42	U
chloroethane	83	U	dibromochloromethane	42	U
methylene chloride	170	B	1,1,2-trichloroethane	42	U
acetone	350	B	benzene	42	U
carbon disulfide	42	U	trans-1,3-dichloropropene	42	U
1,1-dichloroethene	42	U	bromoform	42	U
1,1-dichloroethane	42	U	4-methyl-2-pentanone	83	U
1,2-dichloroethene (total)	42	U	2-hexanone	83	U
chloroform	42	U	tetrachloroethene	42	U
1,2-dichloroethane	42	U	1,1,2,2-tetrachloroethane	42	U
2-butanone	83	U	toluene	42	U
1,1,1-trichloroethane	42	U	chlorobenzene	42	U
carbon tetrachloride	42	U	ethylbenzene	42	U
vinyl acetate	83	U	styrene	42	U
bromodichloromethane	42	U	xylenes (total)	42	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
B - Analyte was found in the blank as well as the sample.
J - Indicates an estimated value.

Date of Analysis: 05/07/93

IT Corporation
May 25, 1993

Client Project ID: Weston

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN
Job Number: ITDK 53933

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Reactor S-2
Lab Sample ID: XX2382

Tentative Identification (1)	Concentration (2)
None detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Reactor S-2 DL
Lab Sample ID: XX2382

Compound	Concentration		Compound	Concentration	
chloromethane	420	U	1,2-dichloropropane	210	U
bromomethane	420	U	cis-1,3-dichloropropene	210	U
vinyl chloride	420	U	trichloroethene	210	U
chloroethane	420	U	dibromochloromethane	210	U
methylene chloride	640	BD	1,1,2-trichloroethane	210	U
acetone	710	BD	benzene	210	U
carbon disulfide	210	U	trans-1,3-dichloropropene	210	U
1,1-dichloroethene	210	U	bromoform	210	U
1,1-dichloroethane	210	U	4-methyl-2-pentanone	420	U
1,2-dichloroethene (total)	210	U	2-hexanone	420	U
chloroform	210	U	tetrachloroethene	210	U
1,2-dichloroethane	210	U	1,1,2,2-tetrachloroethane	210	U
2-butanone	420	U	toluene	210	U
1,1,1-trichloroethane	210	U	chlorobenzene	210	U
carbon tetrachloride	210	U	ethylbenzene	210	U
vinyl acetate	420	U	styrene	210	U
bromodichloromethane	210	U	xylenes (total)	210	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
B - Analyte was found in the blank as well as the sample.
D - Surrogates diluted out.
J - Indicates an estimated value.

Date of Analysis: 05/07/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Reactor S-2 DL
Lab Sample ID: XX2382

Tentative Identification (1)	Concentration (2)
None Detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB0507

Compound	Concentration	Compound	Concentration
chloromethane	10 U	1,2-dichloropropane	5 U
bromomethane	10 U	cis-1,3-dichloropropene	5 U
vinyl chloride	10 U	trichloroethene	5 U
chloroethane	10 U	dibromochloromethane	5 U
methylene chloride	18	1,1,2-trichloroethane	5 U
acetone	13	benzene	5 U
carbon disulfide	5 U	trans-1,3-dichloropropene	5 U
1,1-dichloroethene	5 U	bromoform	5 U
1,1-dichloroethane	5 U	4-methyl-2-pentanone	10 U
1,2-dichloroethene (total)	5 U	2-hexanone	10 U
chloroform	5 U	tetrachloroethene	5 U
1,2-dichloroethane	5 U	1,1,2,2-tetrachloroethane	5 U
2-butanone	10 U	toluene	5 U
1,1,1-trichloroethane	5 U	chlorobenzene	5 U
carbon tetrachloride	5 U	ethylbenzene	5 U
vinyl acetate	10 U	styrene	5 U
bromodichloromethane	5 U	xylenes (total)	5 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

Date of Analysis: 05/07/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB0507

Tentative Identification (1)	Concentration (2)
None detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

	VOLATILE		
Client Sample ID	Toluene-D8 (81-117%)*	BFB (74-121%)*	1,2 Dichloroethane-D4 (70-121%)*
Reactor S-2	138 **	67 **	92
Reactor S-2 DL	116	96	97
Method Blank	98	96	92

* - Values in parentheses represent QC limits.
** - Values outside of contract required QC limits.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

May 26, 1993

Job Number: ITDK 54005

P.O. Number: 580000.045

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston
Date Received by Lab:	05/04/93
Number of Samples:	Three (3)
Sample Type:	Solid

I. Introduction

On 05/04/93, three (3) solid samples arrived at the ITAS-Knoxville, Tennessee, laboratory from IT Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The samples were analyzed for volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8240.

Reviewed and Approved:

Alyce R. Moore
Laboratory Manager

The samples were analyzed for the requested metals by inductively coupled argon plasma spectroscopy (ICP) based on EPA method 6010.

The samples were analyzed for sulfide based on EPA method 9030.

III. Quality Control

Routine laboratory level I QC was followed.

The volatiles analyses were performed by purge and trap with a J & W DB-624 megabore column on a Finnigan OWA GC/MS/DS. The sample showed poor surrogate recoveries and was reanalyzed. The results of the second analysis were consistent with the first results, indicating that the matrix was responsible for the outliers. Both sets of data were submitted for comparison. There were no problems seen in final data review.

The samples were digested on 05/14/93 for ICP; the requested metals were analyzed by ICP on 05/20/93. All run QC was acceptable. No problems were encountered.

The samples were analyzed for sulfide by iodometric titration. Two grams of sample were added to 200 ml of DI water; the solution was agitated with a magnetic stirrer and titrated according to the referenced method. The results are reported as water-leachable concentrations of the analyte. No problems were encountered.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: RX Slurry
Lab Sample ID: XX3102

Compound	Concentration	Compound	Concentration
chloromethane	29 U	1,2-dichloropropane	14 U
bromomethane	29 U	cis-1,3-dichloropropene	14 U
vinyl chloride	29 U	trichloroethene	14 U
chloroethane	29 U	dibromochloromethane	14 U
methylene chloride	12 BJ	1,1,2-trichloroethane	14 U
acetone	29 U	benzene	14 U
carbon disulfide	14 U	trans-1,3-dichloropropene	14 U
1,1-dichloroethene	14 U	bromoform	14 U
1,1-dichloroethane	14 U	4-methyl-2-pentanone	29 U
1,2-dichloroethene (total)	14 U	2-hexanone	29 U
chloroform	14 U	tetrachloroethene	14 U
1,2-dichloroethane	14 U	1,1,2,2-tetrachloroethane	14 U
2-butanone	29 U	toluene	14 U
1,1,1-trichloroethane	14 U	chlorobenzene	14 U
carbon tetrachloride	14 U	ethylbenzene	14 U
vinyl acetate	29 U	styrene	14 U
bromodichloromethane	14 U	xylenes (total)	14 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 05/18/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: RX Slurry
Lab Sample ID: XX3102

Tentative Identification (1)	Concentration (2)
None detected	

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: RX Slurry RE
Lab Sample ID: XX3102

Compound	Concentration	Compound	Concentration
chloromethane	29 U	1,2-dichloropropane	14 U
bromomethane	29 U	cis-1,3-dichloropropene	14 U
vinyl chloride	29 U	trichloroethene	14 U
chloroethane	29 U	dibromochloromethane	14 U
methylene chloride	50 B	1,1,2-trichloroethane	14 U
acetone	16 BJ	benzene	14 U
carbon disulfide	14 U	trans-1,3-dichloropropene	14 U
1,1-dichloroethene	14 U	bromoform	14 U
1,1-dichloroethane	14 U	4-methyl-2-pentanone	29 U
1,2-dichloroethene (total)	14 U	2-hexanone	29 U
chloroform	14 U	tetrachloroethene	14 U
1,2-dichloroethane	14 U	1,1,2,2-tetrachloroethane	14 U
2-butanone	29 U	toluene	14 U
1,1,1-trichloroethane	14 U	chlorobenzene	14 U
carbon tetrachloride	14 U	ethylbenzene	14 U
vinyl acetate	29 U	styrene	14 U
bromodichloromethane	14 U	xylenes (total)	14 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
B - Analyte was found in the blank as well as the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 05/18/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: RX Slurry RE
Lab Sample ID: XX3102

Tentative Identification (1)	Concentration (2)
None detected	

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB0518

Compound	Concentration	Compound	Concentration
chloromethane	10 U	1,2-dichloropropane	5 U
bromomethane	10 U	cis-1,3-dichloropropene	5 U
vinyl chloride	10 U	trichloroethene	5 U
chloroethane	10 U	dibromochloromethane	5 U
methylene chloride	4 J	1,1,2-trichloroethane	5 U
acetone	7 J	benzene	5 U
carbon disulfide	5 U	trans-1,3-dichloropropene	5 U
1,1-dichloroethene	5 U	bromoform	5 U
1,1-dichloroethane	5 U	4-methyl-2-pentanone	10 U
1,2-dichloroethene (total)	5 U	2-hexanone	10 U
chloroform	5 U	tetrachloroethene	5 U
1,2-dichloroethane	5 U	1,1,2,2-tetrachloroethane	5 U
2-butanone	10 U	toluene	5 U
1,1,1-trichloroethane	5 U	chlorobenzene	5 U
carbon tetrachloride	5 U	ethylbenzene	5 U
vinyl acetate	10 U	styrene	5 U
bromodichloromethane	5 U	xylenes (total)	5 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 05/18/93

IT Corporation
May 26, 1993

Client Project ID: Weston

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Job Number: ITDK 54005

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB0518

Tentative Identification (1)	Concentration (2)
None detected	

Remarks: (1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

	VOLATILE		
Client Sample ID	Toluene-D8 (81-117%)*	BFB (74-121%)*	1,2 Dichloroethane-D4 (70-121%)*
RX Slurry	116	66 **	92
RX Slurry RE	126 **	64 **	98
Method Blank	100	93	97

* - Values in parenthesis represent QC limits.
** - Values outside required QC limits.

PRIORITY POLLUTANT METALS ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID: Effluent 1-3
Lab Sample ID: XX3103

Compound	Concentration
arsenic	11.8
barium	45.5
cadmium	1.7
chromium	8.4
lead	32.0

Digestion Date: 05/14/93
Analysis Date: 05/20/93

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
B - Value greater than instrument detection limit, but less than contract required quantitation limit.

PRIORITY POLLUTANT METALS ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID: INF32693-02
Lab Sample ID: XX3104

Compound	Concentration
arsenic	35.3
barium	61.7
cadmium	1.2
chromium	8.1
lead	29.6

Digestion Date: 05/14/93
Analysis Date: 05/20/93

PRIORITY POLLUTANT METALS ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID: RX Slurry
Lab Sample ID: XX3105

Compound	Concentration
arsenic	27.2
barium	62.9
cadmium	1.8
chromium	10.0
lead	32.4

Digestion Date: 05/14/93
Analysis Date: 05/20/93

PRIORITY POLLUTANT METALS ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: PBS-I2370

Compound	Concentration	
arsenic	4.000	U
barium	0.200	U
cadmium	0.500	U
chromium	1.000	U
lead	4.000	U

Digestion Date: 05/14/93
Analysis Date: 05/20/93

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

SULFIDE ANALYSIS

Results in mg/kg (ppm)

Sample Matrix: Soil

Client Sample ID	Lab Sample ID	Result
Method Blank	P5050	40 U
Effluent 1-3	XX3106	480
Rx Slurry	XX3107	140

Date of Analysis: 05/11/93

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
Attn: Kandi Brown

May 29, 1993

Job Number: ITDK 53963

P.O. Number: 580000.045

This is the Certificate of Analysis for the following sample:

Client Project ID:	Weston
Date Received by Lab:	04/29/93
Number of Samples:	One (1)
Sample Type:	Slurry

I. Introduction

On 04/29/93, one (1) slurry sample arrived at the ITAS-Knoxville, Tennessee, laboratory from IT-Biotechnology Applications Center, Knoxville, Tennessee, in support of the Weston project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The sample was analyzed for volatile organic compounds by gas chromatography/mass spectroscopy (GC/MS) based on EPA SW-846 3rd edition, method 8240.

Reviewed and Approved:

Alyce R. Moore
Laboratory Manager

III. Quality Control

The volatiles analyses were performed by purge and trap with a J&W DB-624 megabore column on a Finnigan OWA GC/MS/DS unit. The sample analyses generally went well. The sample matrix interfered with recovery of surrogate standards and internal standards. A second analysis at five-fold dilution proved compliant, but had an elevated detection limit. Both sets of data were provided for comparison. There were no other problems seen in final data review.

IT Corporation
May 29, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 53963

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY
Lab Sample ID: XX2676

Compound	Concentration		Compound	Concentration	
chloromethane	33	U	1,2-dichloropropane	17	U
bromomethane	33	U	cis-1,3-dichloropropene	17	U
vinyl chloride	33	U	trichloroethene	17	U
chloroethane	33	U	dibromochloromethane	17	U
methylene chloride	34	B	1,1,2-trichloroethane	17	U
acetone	110	B	benzene	17	U
carbon disulfide	17	U	trans-1,3-dichloropropene	17	U
1,1-dichloroethene	17	U	bromoform	17	U
1,1-dichloroethane	17	U	4-methyl-2-pentanone	33	U
1,2-dichloroethene (total)	17	U	2-hexanone	33	U
chloroform	17	U	tetrachloroethene	17	U
1,2-dichloroethane	17	U	1,1,2,2-tetrachloroethane	17	U
2-butanone	33	U	toluene	17	U
1,1,1-trichloroethane	17	U	chlorobenzene	17	U
carbon tetrachloride	17	U	ethylbenzene	17	U
vinyl acetate	33	U	styrene	17	U
bromodichloromethane	17	U	xylenes (total)	17	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.

Date of Analysis: 05/13/93

IT Corporation
May 29, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 5396

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY
Lab Sample ID: XX2676

Tentative Identification (1)	Concentration (2)
cyclohexanone (ACN)	74

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY DL
Lab Sample ID: XX2676

Compound	Concentration		Compound	Concentration	
chloromethane	170	U	1,2-dichloropropane	83	U
bromomethane	170	U	cis-1,3-dichloropropene	83	U
vinyl chloride	170	U	trichloroethene	83	U
chloroethane	170	U	dibromochloromethane	83	U
methylene chloride	250	BD	1,1,2-trichloroethane	83	U
acetone	200	BD	benzene	83	U
carbon disulfide	83	U	trans-1,3-dichloropropene	83	U
1,1-dichloroethene	83	U	bromoform	83	U
1,1-dichloroethane	83	U	4-methyl-2-pentanone	170	U
1,2-dichloroethene (total)	83	U	2-hexanone	170	U
chloroform	83	U	tetrachloroethene	83	U
1,2-dichloroethane	83	U	1,1,2,2-tetrachloroethane	83	U
2-butanone	170	U	toluene	83	U
1,1,1-trichloroethane	83	U	chlorobenzene	83	U
carbon tetrachloride	83	U	ethylbenzene	83	U
vinyl acetate	170	U	styrene	83	U
bromodichloromethane	83	U	xylenes (total)	83	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.
B - Analyte was found in the blank as well as the sample.
D - Compound analyzed at a secondary dilution factor.

Date of Analysis: 05/13/93

IT Corporation
May 29, 1993

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: Weston

Job Number: ITDK 5396

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Rx SLURRY DL
Lab Sample ID: XX2676

Tentative Identification (1)	Concentration (2)
cyclohexanone (ACN)	210

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB0513

Compound	Concentration		Compound	Concentration	
chloromethane	10	U	1,2-dichloropropane	5	U
bromomethane	10	U	cis-1,3-dichloropropene	5	U
vinyl chloride	10	U	trichloroethene	5	U
chloroethane	10	U	dibromochloromethane	5	U
methylene chloride	2	J	1,1,2-trichloroethane	5	U
acetone	5	J	benzene	5	U
carbon disulfide	5	U	trans-1,3-dichloropropene	5	U
1,1-dichloroethene	5	U	bromoform	5	U
1,1-dichloroethane	5	U	4-methyl-2-pentanone	10	U
1,2-dichloroethene (total)	5	U	2-hexanone	10	U
chloroform	5	U	tetrachloroethene	5	U
1,2-dichloroethane	5	U	1,1,2,2-tetrachloroethane	5	U
2-butanone	10	U	toluene	5	U
1,1,1-trichloroethane	5	U	chlorobenzene	5	U
carbon tetrachloride	5	U	ethylbenzene	5	U
vinyl acetate	10	U	styrene	5	U
bromodichloromethane	5	U	xylenes (total)	5	U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.
J - Indicates an estimated value less than the detection limit.

Date of Analysis: 05/13/93

ADDITIONAL VOLATILE ORGANIC COMPOUNDS

Results in µg/kg (ppb)

Sample Matrix: Soil

Client Sample ID: Method Blank
Lab Sample ID: VB0513

Tentative Identification (1)	Concentration (2)
None detected	

Remarks:
(1) Identification is based on computer search of the NIST Library.
(2) Concentration is based on a response factor of 1.00 relative to the internal standard.

SOIL SURROGATE PERCENT RECOVERY SUMMARY

	VOLATILE		
Client Sample ID	Toluene-D8 (81-117%)*	BFB (74-121%)*	1,2 Dichloroethane-D4 (70-121%)*
Rx SLURRY	141 **	65 **	87
Rx SLURRY DL	112	86	93
Method Blank	100	98	86

* - Values in parentheses represent QC limits.
** - Values outside QC limits.

EPA Method TO-14

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
9041 Executive Park Drive
Knoxville, TN 37923

Date: March 2, 1993

Attn: Ms. Kandi Brown

Job Number 22010

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston Bioreactor Treatability Study
Date Received:	February 9, 1993
Work Order:	X3-02-068
Number of Samples:	4
Sample Type:	Canister/Tube

I. Introduction

Four samples arrived at ITAS Cincinnati on February 9, 1993. The samples were collected on January 28, 1993 and February 3, 1993 and were labeled as follows:

Can # 12893C (1)
Can # 2393C (1)
Tube # 12993
Tube # 20493

(1) Samples voided per the client's request.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. The data will include sample identification information, the analytical results, and the appropriate detection limits.

The analysis requested was PAH Semi-Volatile Organics by Gas Chromatography/Mass Spectrometry; EPA Method 8270.

Reviewed and Approved by:

Laurel Tomassoni
Project Manager
302068

Robert P. Di Rienzo
Laboratory Director

III. Quality Control

Immediately following the analytical data for the samples can be found the QA/QC information that pertains to these samples. The purpose of this information is to demonstrate that the data enclosed is scientifically valid and defensible. The QA/QC data is used to assess the laboratory's performance during the analysis of the samples it accompanies. All quantitations were performed within the calibrated range of the analytical instrument.

IV. Data Report Qualifiers

Following are descriptions of data report qualifiers which may have been used in this analytical report.

U The analyte was not detected in the sample or extract. The value reported with the "U" is the detection limit for that compound in that sample.

VALUE The result is a value equal to or greater than the detection limit for that compound.

J Indicates an estimated value. This flag is used when mass spectral data indicates the presence of the compound, but the result is less than the specified detection limit.

Client: Weston
Work Order: X3-02-068
30206802

IT ANALYTICAL SERVICES
CINCINNATI, OH

PAH Semi-Volatile Organics

Client Sample ID: Tube # 12993

Lab Sample ID: X2-02-068-03

Analysis Date: March 1, 1993

Dilution Factor: 1

CAS Number		ug/Tube
91-20-3	Naphthalene	10 U
91-57-6	2-Methylnaphthalene	10 U
83-32-9	Acenaphthene	10 U
132-64-9	Dibenzofuran	10 U
86-73-7	Fluorene	10 U
53-70-3	Dibenzo(a,h)anthracene	10 U
85-01-8	Phenanthrene	10 U
120-12-7	Anthracene	10 U

Client: Weston
Work Order: X3-02-068
30206803

IT ANALYTICAL SERVICI
CINCINNATI, OH

PAH Semi-Volatile Organics

Client Sample ID: Tube # 20493

Lab Sample ID: X2-02-068-04

Analysis Date: March 1, 1993

Dilution Factor: 1

CAS Number		ug/Tube
91-20-3	Naphthalene	10 U
91-57-6	2-Methylnaphthalene	10 U
83-32-9	Acenaphthene	10 U
132-64-9	Dibenzofuran	10 U
86-73-7	Fluorene	10 U
53-70-3	Dibenzo(a,h)anthracene	10 U
85-01-8	Phenanthrene	10 U
120-12-7	Anthracene	10 U

Client: Weston
Work Order: X3-02-068
30206804

IT ANALYTICAL SERVICES
CINCINNATI, OH

PAH Semi-Volatile Organics

Client Sample ID:

Lab Sample ID: Solvent Check (Methylene Chloride)

Analysis Date: January 12, 1993

Dilution Factor: 1

CAS Number		Total ug
91-20-3	Naphthalene	10 U
91-57-6	2-Methylnaphthalene	10 U
83-32-9	Acenaphthene	10 U
132-64-9	Dibenzofuran	10 U
86-73-7	Fluorene	10 U
53-70-3	Dibenzo(a,h)anthracene	10 U
85-01-8	Phenanthrene	10 U
120-12-7	Anthracene	10 U

COC NO. 0000254

Copy

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INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 4252
Page 1 of ___

Project Name/No. 1 Weston/Steece . C45
Sample Team Members 2 J. [illegible]/T. S[illegible]
Profit Center No. 3 3978
Project Manager 4 K. Brown
Purchase Order No. 6
Required Report Date 11

Samples Shipment Date 7 02/04/93
Lab Destination 8 ITAS - Cincinnati
Lab Contact 9 David Neal
Project Contact/Phone 12 K. Brown / 615-[illegible]
Carrier/Waybill No. 13

Bill to: 5
Report to: 10 K. Brown

ONE CONTAINER PER LINE

Sample Number 14	Sample Description/Type 15	Date/Time Collected 16	Container Type 17	Sample Volume 18	Preservative 19	Requested Testing Program 20	Condition on Receipt 21	Disposal Record No. 22
12893C	Ambient Air Sample	1/29/93 1400	Metal Canister	1 Canister	None	VOC EPA Method TO-14	[illegible]	0001126
2393C	↓	2/3/93 1400	↓	↓	↓	↓	Sufficient condition. IV	0001127
12893-12193	Air Sample	1/29/93 1400	ORBO-43 Tube	1 Tube		PAH NIOSH Method 5506	Custody seal intact.	
2393-20493	↓	2/3/93 1400	↓	↓	↓	↓	[illegible] Cuttle 2/9/93	
						8270	0900	
Tim Schalk						Kandi Brown	2/10/93	

[illegible] See QA Summary for compounds (Aspentine included for VOC)

Special Instructions: 23 ORBO Tubes sample 30 liters of Air

Possible Hazard Identification: 24
Non-hazard ☑ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: 25
Return to Client ☐ Disposal by Lab ☐ Archive ___ (mos.)

Turnaround Time Required: 26
Normal ☑ Rush ☐

QC Level: 27
I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by 28 (Signature/Affiliation) Timothy S. Schalk	Date: 02/04/93 Time: 1445	1. Received by 28 (Signature/Affiliation) [illegible] Cuttle ITAS Ci	Date: 2/9/93 Time: 0900
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: 29

INTERNATIONAL TECHNOLOGY CORPORATION

[illegible] CHAIN OF CUSTODY RECORD*

Page 1 of ____

Project Name/No. [1] Weston/580000.045 | Samples Shipment Date [7] 02/04/93 | Bill to: [5]

Sample Team Members [2] J. Rightmyer/T. Schalk | Lab Destination [8] ITAS - Cincinnati

Profit Center No. [3] 3178 | Lab Contact [9] David Neal

Project Manager [4] Kandi Brown | Project Contact/Phone [12] K. Brown / 615-690-3211 | Report to: [10] K. Brown

Purchase Order No. [6] | Carrier/Waybill No. [13]

Required Report Date [11]

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Preservative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
12493C	Reactor Air Sample Metro Canister	1/28/93 1400	Metro Canister	1 CANISTER	None	VOC EPA METHOD TO-14	Rcvd in good condition. NO Custody seal intact. Q Cwith 2/9/93 0900	
23136	↓	2/3/93 1400	↓	↓	↓	↓		
12493	Air Sample	1/28/93 1400	ORBO-43 Tube	1 TUBE	↓	PAH NIOSH METHOD 5506		
2393	↓	2/3/93 1400	↓	↓	↓	↓		

Special Instructions: [23] ORBO Tubes Sample 36 Liters of Air

Possible Hazard Identification: [24]
Non-hazard ☑ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☐ Archive ____ (mos.)

Turnaround Time Required: [26]
Normal ☑ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify): ____

1. Relinquished by [28] (Signature/Affiliation) Timothy S Schalk	Date: 02/04/93 Time: 1445	1. Received by [28] (Signature/Affiliation) [illegible] with ITAS, Cin	Date: 2/9/93 Time: 0900
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]

White: To accompany samples. Yellow: Field copy

See back of form for special instructions.

MCA 000291

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
304 Directors Drive
Knoxville, TN 37923

Date: March 29, 1993

Attn: Mr. Tim Schalk

Project Number 226

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston
Date Received:	March 8, 1993
Work Order:	234
Number of Samples:	8
Sample Type:	Air

I. Introduction

Eight samples arrived at ITAS Cincinnati on March 8, 1993. The samples were collected between February 11, 1993 through March 4, 1993 and were labeled as follows:

Tube # 21193	Canister # 21293C
Tube # 21793	Canister # 21893C
Tube # 22593	Canister # 22593C
Tube # 3493	Canister # 3493C

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. The data will include sample identification information, the analytical results, and the appropriate detection limits.

The analyses requested included Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry; NIOSH Method 5506 and Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry; Method TO-14.

Reviewed and Approved by:

Laurel Tomassoni
Project Manager
03234

Kevin Michlewicz, Ph.D
Systems Manager

III. Quality Control

Immediately following the analytical data for the samples can be found the QA/QC information that pertains to these samples. The purpose of this information is to demonstrate that the data enclosed is scientifically valid and defensible. This QA/QC data is used to assess the laboratory's performance during the analysis of the samples it accompanies. All quantitations were performed within the calibrated range of the analytical instrument.

IV. Data Report Qualifiers

Following are descriptions of data report qualifiers which may have been used in this analytical report.

J Indicates an estimated value. This flag is used when mass spectral data indicates the presence of the compound, but the result is less than the specified detection limit.

V. Comments

A interference with 1,3,5-trimethylbenzene made it difficult to confirm the the presence of the compound. Therefore, the detection limit has been elevated for samples 21293C and 22593C.

Client: Weston
Work Order: 234
0323408

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Tube # 21193 2/11/93

Lab Sample ID: AA1600

Analysis Date: March 23, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Q	Detection Limit
Naphthalene	ND		10
Acenaphthylene	ND		10
Acenaphthene	ND		10
Fluorene	ND		10
Phenanthrene	ND		10
Anthracene	ND		10
Fluoranthene	ND		10
Pyrene	ND		10
Benzo(a)anthracene	ND		10
Chrysene	ND		10
Benzo(b)fluoranthene	ND		10
Benzo(k)fluoranthene	ND		10
Benzo(a)pyrene	ND		10
Indeno(1,2,3-cd)pyrene	ND		10
Dibenz(a,h)anthracene	ND		10
Benzo(g,h,i)perylene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323409

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Tube # 21793 2/17/93

Lab Sample ID: AA1601

Analysis Date: March 23, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Q	Detection Limit
Naphthalene	ND		10
Acenaphthylene	ND		10
Acenaphthene	ND		10
Fluorene	ND		10
Phenanthrene	ND		10
Anthracene	ND		10
Fluoranthene	ND		10
Pyrene	ND		10
Benzo(a)anthracene	ND		10
Chrysene	ND		10
Benzo(b)fluoranthene	ND		10
Benzo(k)fluoranthene	ND		10
Benzo(a)pyrene	ND		10
Indeno(1,2,3-cd)pyrene	ND		10
Dibenz(a,h)anthracene	ND		10
Benzo(g,h,i)perylene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323410

IT ANALYTICAL SERVICE
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Tube # 22593 2/25/93

Lab Sample ID: AA1602

Analysis Date: March 23, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Q	Detection Limit
Naphthalene	ND		10
Acenaphthylene	ND		10
Acenaphthene	1	J	10
Fluorene	ND		10
Phenanthrene	ND		10
Anthracene	ND		10
Fluoranthene	ND		10
Pyrene	ND		10
Benzo(a)anthracene	ND		10
Chrysene	ND		10
Benzo(b)fluoranthene	ND		10
Benzo(k)fluoranthene	ND		10
Benzo(a)pyrene	ND		10
Indeno(1,2,3-cd)pyrene	ND		10
Dibenz(a,h)anthracene	ND		10
Benzo(g,h,i)perylene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323411

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Canister # 3493C 3/4/93

Lab Sample ID: AA1607

Analysis Date: March 23, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Q	Detection Limit
Naphthalene	ND		10
Acenaphthylene	ND		10
Acenaphthene	2	J	10
Fluorene	ND		10
Phenanthrene	ND		10
Anthracene	ND		10
Fluoranthene	ND		10
Pyrene	ND		10
Benzo(a)anthracene	ND		10
Chrysene	ND		10
Benzo(b)fluoranthene	ND		10
Benzo(k)fluoranthene	ND		10
Benzo(a)pyrene	ND		10
Indeno(1,2,3-cd)pyrene	ND		10
Dibenz(a,h)anthracene	ND		10
Benzo(g,h,i)perylene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323412

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank

Analysis Date: March 23, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Q	Detection Limit
Naphthalene	ND		10
Acenaphthylene	ND		10
Acenaphthene	ND		10
Fluorene	ND		10
Phenanthrene	ND		10
Anthracene	ND		10
Fluoranthene	ND		10
Pyrene	ND		10
Benzo(a)anthracene	ND		10
Chrysene	ND		10
Benzo(b)fluoranthene	ND		10
Benzo(k)fluoranthene	ND		10
Benzo(a)pyrene	ND		10
Indeno(1,2,3-cd)pyrene	ND		10
Dibenz(a,h)anthracene	ND		10
Benzo(g,h,i)perylene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323410

IT ANALYTICAL SERVICES
CINCINNATI, OH

Quality Assurance Data

Volatile
Surrogate Recovery, Percent

Client Sample ID	Lab No.	d4-1,2-Dichloroethane	d8-Toluene	p-Bromofluorobenzene
Canister # 21293C	AA1604	101	98	96
Canister # 21893C	AA1605	100	101	93
	AA1605 DL	103	100	99
Canister # 22593C	AA1606	98	100	94
	AA1606 DL	106	98	100
Canister # 3493C	AA1607	99	101	91
	AA1607 DL	105	100	101
Method Blank	ABLK01	99	100	98
Method Blank	ABLK02	100	100	99

Client: Weston
Work Order: 234
0323403

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Canister # 21293C 2/12/93

Lab Sample ID: AA1604

Analysis Date: March 16, 1993

Dilution Factor: 4.4

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		0.9
n-Pentane	1.1		2.2
1,1,2-Trichlorotrifluoroethane	ND		1.3
Methylene Chloride	28		0.9
Hexane	ND		1.8
1,1,1-Trichloroethane	3.8		1.3
Benzene	0.8	J	0.9
Toluene	1.6		0.9
n-Octane	0.4	J	0.9
Ethylbenzene	ND		0.9
m/p-Xylene	ND		0.9
o-Xylene	ND		0.9
n-Nonane	0.4	J	0.9
Styrene	ND		0.9
Cumene	ND		0.9
Decane	1.0		0.9
n-Undecane	1.3		0.9
n-Dodecane	1.0		0.9
1,3,5-Trimethylbenzene	ND		3
1,2,4-Trimethylbenzene	0.4	J	0.9
N-Heptane	ND		0.9

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323407

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Canister # 21893C

Lab Sample ID: AA1605

Analysis Date: March 16, 1993 & March 17, 1993 3/17/93

Dilution Factor: 7.3

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		1.5
n-Pentane	ND		3.7
1,1,2-Trichlorotrifluoroethane	ND		2.2
Methylene Chloride	180	(1)	8
Hexane	1.0	J	2.9
1,1,1-Trichloroethane	21		2.2
Benzene	0.8	J	1.5
Toluene	2.1		1.5
n-Octane	ND		1.5
Ethylbenzene	ND		1.5
m/p-Xylene	ND		1.5
o-Xylene	ND		1.5
n-Nonane	ND		1.5
Styrene	ND		1.5
Cumene	ND		1.5
Decane	0.9	J	1.5
n-Undecane	1.0	J	1.5
n-Dodecane	ND		1.5
1,3,5-Trimethylbenzene	ND		1.5
1,2,4-Trimethylbenzene	ND		1.5
N-Heptane	ND		1.5

ND = Not detected at or above the reported detection limit

(1) Dilution Factor = 40

Client: Weston
Work Order: 234
0323404

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Canister # 22593C 2/25/93

Lab Sample ID: AA1606

Analysis Date: March 16, 1993 & March 17, 1993

Dilution Factor: 4.1

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		0.8
n-Pentane	1.3		2.1
1,1,2-Trichlorotrifluoroethane	ND		1.2
Methylene Chloride	93	(1)	4
Hexane	0.5	J	1.6
1,1,1-Trichloroethane	120	(1)	6
Benzene	0.7	J	0.8
Toluene	2.4		0.8
n-Octane	ND		0.8
Ethylbenzene	ND		0.8
m/p-Xylene	0.5	J	0.8
o-Xylene	ND		0.8
n-Nonane	ND		0.8
Styrene	ND		0.8
Cumene	ND		0.8
Decane	0.5	J	0.8
n-Undecane	0.6	J	0.8
n-Dodecane	0.5	J	0.8
1,3,5-Trimethylbenzene	ND		2
1,2,4-Trimethylbenzene	ND		0.8
N-Heptane	ND		0.8

ND = Not detected at or above the reported detection limit

(1) Dilution Factor = 20

Client: Weston
Work Order: 234
0323402

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Canister # 3493C 3/4/93

Lab Sample ID: AA1607

Analysis Date: March 16, 1993 & March 17, 1993

Dilution Factor: 17.8

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		3.6
n-Pentane	ND		8.9
1,1,2-Trichlorotrifluoroethane	ND		5.3
Methylene Chloride	53		3.6
Hexane	2.0	J	7.1
1,1,1-Trichloroethane	.200	(1)	50
Benzene	ND		3.6
Toluene	2.8	J	3.6
n-Octane	ND		3.6
Ethylbenzene	ND		3.6
m/p-Xylene	ND		3.6
o-Xylene	ND		3.6
n-Nonane	ND		3.6
Styrene	ND		3.6
Cumene	ND		3.6
Decane	ND		3.6
n-Undecane	ND		3.6
n-Dodecane	ND		3.6
1,3,5-Trimethylbenzene	ND		3.6
1,2,4-Trimethylbenzene	ND		3.6
N-Heptane	ND		3.6

ND = Not detected at or above the reported detection limit

(1) Dilution Factor = 168

Client: Weston
Work Order: 234
0323405

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank - ABLK01

Analysis Date: March 16, 1993

Dilution Factor: 1

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		0.2
n-Pentane	ND		0.5
1,1,2-Trichlorotrifluoroethane	ND		0.3
Methylene Chloride	ND		0.2
Hexane	ND		0.4
1,1,1-Trichloroethane	ND		0.3
Benzene	ND		0.2
Toluene	ND		0.2
n-Octane	ND		0.2
Ethylbenzene	ND		0.2
m/p-Xylene	ND		0.2
o-Xylene	ND		0.2
n-Nonane	ND		0.2
Styrene	ND		0.2
Cumene	ND		0.2
Decane	ND		0.2
n-Undecane	ND		0.2
n-Dodecane	ND		0.2
1,3,5-Trimethylbenzene	ND		0.2
1,2,4-Trimethylbenzene	ND		0.2
N-Heptane	ND		0.2

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323406

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank - ABLK02

Analysis Date: March 17, 1993

Dilution Factor: 1

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		0.2
n-Pentane	ND		0.5
1,1,2-Trichlorotrifluoroethane	ND		0.3
Methylene Chloride	ND		0.2
Hexane	ND		0.4
1,1,1-Trichloroethane	ND		0.3
Benzene	ND		0.2
Toluene	ND		0.2
n-Octane	ND		0.2
Ethylbenzene	ND		0.2
m/p-Xylene	ND		0.2
o-Xylene	ND		0.2
n-Nonane	ND		0.2
Styrene	ND		0.2
Cumene	ND		0.2
Decane	ND		0.2
n-Undecane	ND		0.2
n-Dodecane	ND		0.2
1,3,5-Trimethylbenzene	ND		0.2
1,2,4-Trimethylbenzene	ND		0.2
N-Heptane	ND		0.2

ND = Not detected at or above the reported detection limit

WO 234

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311492
Page 1 of ____

Project Name/No. [1] Weston/580000.045
Samples Shipment Date [7] 03/05/93
Bill to: [5] 580000.045
Sample Team Members [2] T. Schalk / J. Rightmyer
Lab Destination [8] ITAS Cincinnati
Profit Center No. [3] L3976
Lab Contact [9] ~~David~~ Julie Moore
Project Manager [4] Kand. Brown
Project Contact/Phone [12] K. Brown / 610-3211
Report to: [10] K. Brown
Purchase Order No. [6]
Carrier/Waybill No. [13]
Required Report Date [11]

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Preservative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
21193	Remote Air Sample	2/11/93 0800	ORBO-43 Tube	36 L Air	None	PAH NIOSH Method 5506	Samples recvd in good condition. No COC seals present. J. Moore 3/8/93	
21793	↓	2/17/93 0800	↓	↓	↓	↓		
22593	↓	2/25/93 0900	↓	↓	↓	↓		
3493	↓	3/4/93 0900	↓	↓	↓	↓		
21293C	Air Sample	2/12/93 1700	Metal Canister	1 Canister		VOC EPA Method 8270		
21893C	↓	2/18/93 1700	↓	↓	↓	↓		
22593C	↓	2/25/93 1700	↓	↓	↓	↓		
3493C	↓	3/4/93 1700	↓	↓	↓	↓		

FOR LAB USE ONLY

Special Instructions: [23]

Possible Hazard Identification: [24]
Non-hazard ☑ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☐ Archive ____ (mos.)

Turnaround Time Required: [26]
Normal ☑ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by [28] (Signature/Affiliation) Timothy S. Schalk	Date: 3/5/93 Time: 1052	1. Received by [28] (Signature/Affiliation) Julie Moore ITAS Ci	Date: 3/8/93 Time: 0905
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

Library

CERTIFICATE OF ANALYSIS

IT Corporation
304 Directors Drive
Knoxville, TN 37923

Date: March 30, 1993

Attn: Kandi Brown

Project Number 226

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston - Desorption Study
Date Received:	March 9, 1993
Work Order:	246
Number of Samples:	2
Sample Type:	Air

I. Introduction

Two samples arrived at ITAS Cincinnati on March 9, 1993. The samples were collected on March 8, 1993 and were labeled as follows:

BLANK A
BLANK B

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. The data will include sample identification information, the analytical results, and the appropriate detection limits.

The analysis requested was PAH Semi-Volatile Organics by NIOSH 5506 modified for Gas Chromatography/Mass Spectrometry; EPA Method 8270. Two concentration levels were examined for the recovery of client specific compounds.

Reviewed and Approved by:

Laurel Tomassoni
Project Manager
03246

Kevin Michlewicz, Ph.D
Systems Manager

III. Quality Control

Immediately following the analytical data for the samples can be found the QA/QC information that pertains to these samples. The purpose of this information is to demonstrate that the data enclosed is scientifically valid and defensible. This QA/QC data is used to assess the laboratory's performance during the analysis of the samples it accompanies. All quantitations were performed within the calibrated range of the analytical instrument.

Client: Weston
Work Order: 246
0324604

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: BLANK A

Lab Sample ID: AA1686

Analysis Date: March 25, 1993

Dilution Factor: 1

CAS Number	COMPOUND	Theoretical	Actual	Percent Recovery
91-20-3	Naphthalene	15	13	118
208-96-8	Acenaphthylene	13	13	104
83-32-9	Acenaphthene	14	13	115
86-73-7	Fluorene	12	13	96
85-01-8	Phenanthrene	13	13	105
120-12-7	Anthracene	12	13	95
206-44-0	Fluoranthene	13	13	104
129-00-0	Pyrene	12	13	95
56-55-3	Benzo(a)anthracene	12	13	99
218-01-9	Chrysene	13	13	100
205-99-2	Benzo(b)fluoranthene	13	13	100
207-08-9	Benzo(k)fluoranthene	11	13	91
50-32-8	Benzo(a)pyrene	12	13	98
193-39-5	Indeno(1,2,3-cd)pyrene	11	13	87
53-70-3	Dibenz(a,h)anthracene	11	13	86
191-24-2	Benzo(g,h,i)perylene	11	13	87

Client: Weston
Work Order: 246
0324603

IT ANALYTICAL SERVICE
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: BLANK B

Lab Sample ID: AA1687

Analysis Date: March 25, 1993

Dilution Factor: 1

CAS Number	COMPOUND	Theoretical	Actual	Percent Recovery
91-20-3	Naphthalene	42	50	83
208-96-8	Acenaphthylene	45	50	89
83-32-9	Acenaphthene	41	50	82
86-73-7	Fluorene	46	50	91
85-01-8	Phenanthrene	46	50	93
120-12-7	Anthracene	53	50	106
206-44-0	Fluoranthene	52	50	104
129-00-0	Pyrene	43	50	85
56-55-3	Benzo(a)anthracene	44	50	89
218-01-9	Chrysene	43	50	86
205-99-2	Benzo(b)fluoranthene	52	50	105
207-08-9	Benzo(k)fluoranthene	51	50	101
50-32-8	Benzo(a)pyrene	53	50	106
193-39-5	Indeno(1,2,3-cd)pyrene	49	50	98
53-70-3	Dibenz(a,h)anthracene	49	50	98
191-24-2	Benzo(g,h,i)perylene	48	50	96

Client: Weston
Work Order: 246
0324605

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: CH2CL2 Blank

Analysis Date: March 25, 1993

Dilution Factor: 1

CAS Number	COMPOUND	ug/Tube	Detection Limit
91-20-3	Naphthalene	ND	10
208-96-8	Acenaphthylene	ND	10
83-32-9	Acenaphthene	ND	10
86-73-7	Fluorene	ND	10
85-01-8	Phenanthrene	ND	10
120-12-7	Anthracene	ND	10
206-44-0	Fluoranthene	ND	10
129-00-0	Pyrene	ND	10
56-55-3	Benzo(a)anthracene	ND	10
218-01-9	Chrysene	ND	10
205-99-2	Benzo(b)fluoranthene	ND	10
207-08-9	Benzo(k)fluoranthene	ND	10
50-32-8	Benzo(a)pyrene	ND	10
193-39-5	Indeno(1,2,3-cd)pyrene	ND	10
53-70-3	Dibenz(a,h)anthracene	ND	10
191-24-2	Benzo(g,h,i)perylene	ND	10

ND = Not detected at or above the reported detection limit

INTERNATIONAL TECHNOLOGY CORPORATION

10 246

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311426
Page 1 of ___

Project Name/No.[1] Weston
Sample Team Members[2] J. Rightmyer
Profit Center No.[3] 3978
Project Manager[4] K. Brown
Purchase Order No.[6]
Required Report Date[11]

Samples Shipment Date[7] 3/8/93
Lab Destination[8] ITAS - Cincinnati
Lab Contact[9] Julie Moore
Project Contact/Phone[12] K. Brown / 216616
Carrier/Waybill No.[13]

Bill to:[5] 580000.045
Report to:[10] K. Brown

White: To accompany samples
Yellow: Field copy

ONE CONTAINER PER LINE

Sample Number[14]	Sample Description/Type[15]	Date/Time Collected[16]	Container Type[17]	Sample Volume[18]	Preservative[19]	Requested Testing Program[20]	Condition on Receipt[21]	Disposal Record No.[22]
BLANK A	Blank	3/8/93	—	—		Contact Kandi Brown	Rwd [illegible] at [illegible] FOR LAB USE ONLY	
BLANK B	Blank	3/8/93	—	—			seal intact @ 0845 on 3/9/93 [illegible] FOR LAB USE ONLY	

Special Instructions:[23]

Possible Hazard Identification:[24]
Non-hazard [X] Flammable [ ] Skin Irritant [ ] Poison B [ ] Unknown [ ]

Sample Disposal:[25]
Return to Client [ ] Disposal by Lab [ ] Archive ___ (mos.)

Turnaround Time Required:[26]
Normal [X] Rush [ ]

QC Level:[27]
I. [ ] II. [ ] III. [ ] Project Specific (specify):

1. Relinquished by[28] (Signature/Affiliation) Janet Rightmyer, IT-BAC	Date: 3/8/93 Time: 9:45 am	1. Received by[28] (Signature/Affiliation) [illegible] ITASC	Date: 3/9/93 Time: 0845
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments:[29]

*See back of form for special instructions.

MCA 3/15/91

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
304 Directors Drive
Knoxville, TN 37923
Attn: K. Brown

Date: April 14, 1993

Project Number 226

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston Air Project
Date Received:	March 24, 1993
Work Order:	370
Number of Samples:	4
Sample Type:	Air

I. Introduction

Four samples arrived at ITAS Cincinnati on March 24, 1993. The samples were collected on March 11, 1993 and March 18, 1993 and were labeled as follows:

Tube # 31893	Can # 31193 C
Tube # 31193	Can # 31893 C

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. The data will include sample identification information, the analytical results, and the appropriate detection limits.

The analyses requested and the methods used are listed on the following page.

Reviewed and Approved by:

Jon Sonderman
Project Manager
03370

Kevin Michlewicz, Ph.D
Laboratory Director

II. Analytical Results/Methodology (cont.)

* Semi-Volatile by Gas Chromatography/Mass Spectrometry; EPA Method 8270

* Volatiles by Gas Chromatography/Mass Spectrometry; Method TO-14
These samples were analyzed by Air Toxics, LTD. under an ITAS subcontract.

III. Quality Control

Immediately following the analytical data for the samples can be found the QA/QC information that pertains to these samples. The purpose of this information is to demonstrate that the data enclosed is scientifically valid and defensible. This QA/QC data is used to assess the laboratory's performance during the analysis of the samples it accompanies. All quantitations were performed within the calibrated range of the analytical instrument.

IV. Data Report Qualifiers

Following are descriptions of data report qualifiers which may have been used in this analytical report.

U The analyte was not detected in the sample or extract. The value reported with the "U" is the detection limit for that compound in that sample.

VALUE The result is a value equal to or greater than the detection limit for that compound.

J Indicates an estimated value. This flag is used when mass spectral data indicates the presence of the compound, but the result is less than the specified detection limit.

B This flag is used whenever the analyte is found in the blank as well as in the sample.

E This flag indicates that the quantity of this compound detected in this sample is above the linear range of the instrument. Results are probably lower than actual.

Client: Weston
Work Order: 370
0337002

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Tube # 31893

Lab Sample ID: AA2480

Analysis Date: March 31, 1993

Dilution Factor: 1

COMPOUND	ug/tube	Detection Limit
Naphthalene	1 J	10
2-Methylnaphthalene	ND	10
Acenaphthene	2 J	10
Dibenzofuran	ND	10
Fluorene	ND	10
Phenanthrene	ND	10
Anthracene	ND	10
Dibenz(a,h)anthracene	ND	10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 370
0337003

IT ANALYTICAL SERVICE
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Tube # 31193

Lab Sample ID: AA2481

Analysis Date: March 31, 1993

Dilution Factor: 1

COMPOUND	ug/tube	Detection Limit
Naphthalene	ND	10
2-Methylnaphthalene	ND	10
Acenaphthene	2 J	10
Dibenzofuran	ND	10
Fluorene	ND	10
Phenanthrene	ND	10
Anthracene	ND	10
Dibenz(a,h)anthracene	ND	10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 370
0337004

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank

Analysis Date: March 31, 1993

Dilution Factor: 1

COMPOUND	ug/tube	Detection Limit
Naphthalene	ND	10
2-Methylnaphthalene	ND	10
Acenaphthene	ND	10
Dibenzofuran	ND	10
Fluorene	ND	10
Phenanthrene	ND	10
Anthracene	ND	10
Dibenz(a,h)anthracene	ND	10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 370
0337005

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Can # 31193 C

Lab Sample ID: AA2482

Analysis Date: April 13, 1993

Dilution Factor: 4.7

COMPOUND	ppbv	Detection Limit
Chlorodifluoromethane	ND	0.5
n-Pentane	ND	0.5
Freon 113	ND	0.5
Methylene Chloride	19	0.5
Hexane	ND	0.5
1,1,1-Trichloroethane	ND	0.5
Benzene	ND	0.5
Toluene	ND	0.5
n-Octane	ND	0.5
Ethyl Benzene	ND	0.5
Total Xylenes	ND	0.5
n-Nonane	ND	0.5
Styrene	ND	0.5
Cumene	ND	0.5
Decane	ND	0.5
n-Undecane	ND	0.5
n-Dodecane	ND	0.5
1,3,5-Trimethylbenzene	ND	0.5
1,2,4-Trimethylbenzene	ND	0.5
n-Heptane	ND	0.5

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 370
0337006

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Can # 31893 C

Lab Sample ID: AA2483

Analysis Date: April 13, 1993

Dilution Factor: 4.3

COMPOUND	ppbv	Detection Limit
Chlorodifluoromethane	ND	0.5
n-Pentane	ND	0.5
Freon 113	ND	0.5
Methylene Chloride	2900 *	17
Hexane	ND	0.5
1,1,1-Trichloroethane	2.3	0.5
Benzene	ND	0.5
Toluene	3.1	0.5
n-Octane	ND	0.5
Ethyl Benzene	ND	0.5
Total Xylenes	ND	0.5
n-Nonane	ND	0.5
Styrene	ND	0.5
Cumene	ND	0.5
Decane	ND	0.5
n-Undecane	ND	0.5
n-Dodecane	ND	0.5
1,3,5-Trimethylbenzene	ND	0.5
1,2,4-Trimethylbenzene	ND	0.5
n-Heptane	ND	0.5

* Reported from a dilution of 17

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 370
0337007

IT ANALYTICAL SERVICE
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank

Analysis Date: April 13, 1993

Dilution Factor: 1

COMPOUND	ppbv	Detection Limit
Chlorodifluoromethane	ND	0.5
n-Pentane	ND	0.5
Freon 113	ND	0.5
Methylene Chloride	ND	0.5
Hexane	ND	0.5
1,1,1-Trichloroethane	ND	0.5
Benzene	ND	0.5
Toluene	ND	0.5
n-Octane	ND	0.5
Ethyl Benzene	ND	0.5
Total Xylenes	ND	0.5
n-Nonane	ND	0.5
Styrene	ND	0.5
Cumene	ND	0.5
Decane	ND	0.5
n-Undecane	ND	0.5
n-Dodecane	ND	0.5
1,3,5-Trimethylbenzene	ND	0.5
1,2,4-Trimethylbenzene	ND	0.5
n-Heptane	ND	0.5

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 370
0337007

IT ANALYTICAL SERVICES
CINCINNATI, OH

Quality Assurance Data

Volatile
Surrogate Recovery, Percent

Client Sample ID	Lab ID	Octafluoro-toluene	d8-Toluene	p-Bromo-fluoro-benzene
Can # 31193 C	AA2482	125	98	84
Can # 31893 C	AA2483	127	96	87
Method Blank		100	101	105

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311316
Page 1 of ____

Project Name/No. [1] Wilson/580000.045
Sample Team Members [2] T. Sobisik/J. Richmyer
Profit Center No. [3] L3478
Project Manager [4] Khosi Brown
Purchase Order No. [6]
Required Report Date [11]

Samples Shipment Date [7] 3/23/93
Lab Destination [8] ITAS Cincinnati
Lab Contact [9] Julie Moore
Project Contact/Phone [12] K. Brown 690-3211
Carrier/Waybill No. [13]

Bill to: [5] 580000.045
Report to: [10] K Brown

ONE CONTAINER PER LINE

Sample [14] Number	Sample [15] Description/Type	Date/Time [16] Collected	Container [17] Type	Sample [18] Volume	Pre- [19] servative	Requested Testing [20] Program	Condition on [21] Receipt	Disposal [22] Record No.
31893	Ambient Air Sample	3/8/93	ORBO-43 Tube	36L Air	None	PAH Niosh Method 5506	Sample received in good condition	
31143	↓	3/11/93	ORBO-43 Tube	36L Air	None	PAH Niosh Method 5506		
							No COC seal present. Temperature of cooler = 19°C.	
31193C	Air Sample	3/11/93	Metal Canister	1 Canister	None	VOC EPA Method TO-14		
31893C	Air Sample	3/18/93	Metal Canister	1 Canister	None	VOC EPA Method TO-14	J Moore 3/24/93	

Special Instructions: [23]

Possible Hazard Identification: [24]
Non-hazard ☑ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☐ Archive (mos.)

Turnaround Time Required: [26]
Normal ☐ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by [28] (Signature/Affiliation)	Date: 3/23/93 Time: 3:00 PM	1. Received by [28] (Signature/Affiliation) Julie Moore ITAS Ci	Date: 3/24/93 Time: 0715
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]

MCA 3 15 91

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
304 Directors Drive
Knoxville, TN 37923

Date: April 30, 1993

Attn: Tim Schalk

Project Number 226

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston
Date Received:	April 6, 1993
Work Order:	477
Number of Samples:	4
Sample Type:	Air

I. Introduction

Four samples arrived at ITAS Cincinnati on April 6, 1993. The samples were collected on March 25, 1993 and April 1, 1993 and were labeled as follows:

040193	04193C
032593	032593C

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. The data will include sample identification information, the analytical results, and the appropriate detection limits.

The analyses requested and methods used are listed on the following page.

Reviewed and Approved by:

Jon Sonderman
Project Manager
04477

Kevin Michlewicz, Ph.D
Laboratory Director

II. Analytical Results/Methodology (cont.)

* PAH Semivolatile Organics by Gas Chromatography/ Mass Spectrometry; Modified NIOSH 5506

* Volatile Organics by Gas Chromatography/ Mass Spectrometry; EPA Method TO-14.

III. Quality Control

Immediately following the analytical data for the samples can be found the QA/QC information that pertains to these samples. The purpose of this information is to demonstrate that the data enclosed is scientifically valid and defensible. This QA/QC data is used to assess the laboratory's performance during the analysis of the samples it accompanies. All quantitations were performed within the calibrated range of the analytical instrument.

IV. Data Report Qualifiers

Following are descriptions of data report qualifiers which may have been used in this analytical report.

U The analyte was not detected in the sample or extract. The value reported with the "U" is the detection limit for that compound in that sample.

VALUE The result is a value equal to or greater than the detection limit for that compound.

J Indicates an estimated value. This flag is used when mass spectral data indicates the presence of the compound, but the result is less than the specified detection limit.

B This flag is used whenever the analyte is found in the blank as well as in the sample.

E This flag indicates that the quantity of this compound detected in this sample is above the linear range of the instrument. Results are probably lower than actual.

Client: Weston
Work Order: 477
0447702

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: 04193C

Lab Sample ID: AA3231

Analysis Date: 4/24/93, 4/26/93, 4/28/93

Dilution Factor: 3.8

COMPOUND	PPB			Detection Limit
Ethylbenzene	ND			0.8
Styrene	ND			0.8
1,3,5-Trimethylbenzene	ND			0.8
Toluene	1.7			0.8
Nonane	ND			0.8
Benzene	0.6	J		0.8
Methylene Chloride	40	B	(1)	11
1,1,1-Trichloroethane	660		(2)	42
1,1,2-Trichloro-1,2,2-trifluoroethane	3.7			1.1
o-Xylene	ND			0.8
1,2,4-Trimethylbenzene	ND			0.8
m/p-Xylene	ND			0.8
Chlorodifluoromethane	ND			0.8
n-Pentane	2.1			1.9
n-Hexane	0.7	J		1.5
n-Octane	ND			0.8
Cumene	ND			0.8
n-Decane	ND			0.8
n-Undecane	0.7	J		0.8
n-Dodecane	0.9			0.8
n-Heptane	ND			0.8

ND = Not detected at or above the reported detection limit

(1) Dilution Factor = 38
(2) Dilution Factor = 141

Client: Weston
Work Order: 477
0447703

IT ANALYTICAL SERVICE
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: 032593C

Lab Sample ID: AA3232

Analysis Date: 4/24/93, 4/26/93

Dilution Factor: 4.6

COMPOUND	PPB	Detection Limit
Ethylbenzene	ND	0.9
Styrene	ND	0.9
1,3,5-Trimethylbenzene	ND	0.9
Toluene	3.2	0.9
Nonane	ND	0.9
Benzene	0.9 J	0.9
Methylene Chloride	94 B (1)	14
1,1,1-Trichloroethane	5.5	1.4
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	1.4
o-Xylene	ND	0.9
1,2,4-Trimethylbenzene	ND	0.9
m/p-Xylene	0.7 J	0.9
Chlorodifluoromethane	2.3	0.9
n-Pentane	1.2	2.3
n-Hexane	1.0 J	1.8
n-Octane	ND	0.9
Cumene	ND	0.9
n-Decane	ND	0.9
n-Undecane	1.1	0.9
n-Dodecane	1.4	0.9
n-Heptane	ND	0.9

ND = Not detected at or above the reported detection limit

(1) Dilution Factor = 46

Client: Weston
Work Order: 477
0447704

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank - ABLKU5

Analysis Date: 4/24/93

Dilution Factor: 1

COMPOUND	PPB	Detection Limit
Ethylbenzene	ND	0.2
Styrene	ND	0.2
1,3,5-Trimethylbenzene	ND	0.2
Toluene	ND	0.2
Nonane	ND	0.2
Benzene	0.2 J	0.2
Methylene Chloride	ND	0.3
1,1,1-Trichloroethane	ND	0.3
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	0.3
o-Xylene	ND	0.2
1,2,4-Trimethylbenzene	ND	0.2
m/p-Xylene	ND	0.2
Chlorodifluoromethane	ND	0.2
n-Pentane	ND	0.5
n-Hexane	ND	0.4
n-Octane	ND	0.2
Cumene	ND	0.2
n-Decane	ND	0.2
n-Undecane	ND	0.2
n-Dodecane	ND	0.2
n-Heptane	ND	0.2

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 477
0447705

IT ANALYTICAL SERVICE
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank - ABLKU8

Analysis Date: 4/26/93

Dilution Factor: 1

COMPOUND	PPB	Detection Limit
Ethylbenzene	ND	0.2
Styrene	ND	0.2
1,3,5-Trimethylbenzene	ND	0.2
Toluene	ND	0.2
Nonane	ND	0.2
Benzene	ND	0.2
Methylene Chloride	0.2 J	0.3
1,1,1-Trichloroethane	ND	0.3
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	0.3
o-Xylene	ND	0.2
1,2,4-Trimethylbenzene	ND	0.2
m/p-Xylene	ND	0.2
Chlorodifluoromethane	ND	0.2
n-Pentane	ND	0.5
n-Hexane	ND	0.4
n-Octane	ND	0.2
Cumene	ND	0.2
n-Decane	ND	0.2
n-Undecane	ND	0.2
n-Dodecane	ND	0.2
n-Heptane	ND	0.2

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 477
0447706

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank - ABLKV2

Analysis Date: 4/28/93

Dilution Factor: 1

COMPOUND	PPB	Detection Limit
Ethylbenzene	ND	0.2
Styrene	ND	0.2
1,3,5-Trimethylbenzene	ND	0.2
Toluene	ND	0.2
Nonane	ND	0.2
Benzene	ND	0.2
Methylene Chloride	0.3 J	0.3
1,1,1-Trichloroethane	ND	0.3
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	0.3
o-Xylene	ND	0.2
1,2,4-Trimethylbenzene	ND	0.2
m/p-Xylene	ND	0.2
Chlorodifluoromethane	ND	0.2
n-Pentane	ND	0.5
n-Hexane	ND	0.4
n-Octane	ND	0.2
Cumene	ND	0.2
n-Decane	ND	0.2
n-Undecane	ND	0.2
n-Dodecane	ND	0.2
n-Heptane	ND	0.2

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 477
0447707

IT ANALYTICAL SERVICES
CINCINNATI, OH

PAH Semivolatile Organic Compounds

Client Sample ID: 040193

Lab Sample ID: AA3229

Analysis Date: 4/22/93

Dilution Factor: 1

COMPOUND	ug/Tube	Detection Limit
Naphthalene	ND	10
2-Methylnaphthalene	ND	10
Acenaphthene	5 J	10
Dibenzofuran	ND	10
Fluorene	ND	10
Phenanthrene	ND	10
Anthracene	ND	10
Dibenzo(a,h)anthracene	ND	10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 477
0447708

IT ANALYTICAL SERVICES
CINCINNATI, OH

PAH Semivolatile Organic Compounds

Client Sample ID: 032593

Lab Sample ID: AA3230

Analysis Date: 4/22/93

Dilution Factor: 1

COMPOUND	ug/Tube	Detection Limit
Naphthalene	1 J	10
2-Methylnaphthalene	ND	10
Acenaphthene	5 J	10
Dibenzofuran	ND	10
Fluorene	ND	10
Phenanthrene	ND	10
Anthracene	ND	10
Dibenzo(a,h)anthracene	ND	10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 477
0447709

IT ANALYTICAL SERVICES
CINCINNATI, OH

PAH Semivolatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank

Analysis Date: 4/22/93

Dilution Factor: 1

COMPOUND	ug/Tube	Detection Limit
Naphthalene	ND	10
2-Methylnaphthalene	ND	10
Acenaphthene	ND	10
Dibenzofuran	ND	10
Fluorene	ND	10
Phenanthrene	ND	10
Anthracene	ND	10
Dibenzo(a,h)anthracene	ND	10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 477
0447720

IT ANALYTICAL SERVICES
CINCINNATI, OH

Quality Assurance Data

Volatile
Surrogate Recovery, Percent

Client Sample ID	Lab No.	d4-1,2-Dichloroethane	d8-Toluene	p-Bromofluorobenzene
04193C	AA3231	100	96	96
	AA3231 DL	96	100	93
	AA3231 D2	100	100	95
032593C	AA3232	104	98	98
	AA3232 DL	98	101	93
Method Blank	ABLKU5	100	99	93
	ABLKU8	97	101	93
	ABLKV2	102	101	93

INTERNATIONAL TECHNOLOGY CORPORATION

COC NO. *0000599*

RV-31L W.O. 411

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311399
Page 1 of 1

Project Name/No.[1] Weston / 580000.045 Samples Shipment Date[7] 4-5-93 Bill to:[5] 580000.041

Sample Team Members[2] T.Sohalk / J.Ristinen Lab Destination[8] ITAS Cincinnati

Profit Center No.[3] 3521 Lab Contact[9] Julie Moore

Project Manager[4] Kandi Brown Project Contact/Phone[12] Kandi Brown 650-3211 Report to:[10] K. Brown

Purchase Order No.[6] Carrier/Waybill No.[13]

Required Report Date[11]

ONE CONTAINER PER LINE

Sample[14] Number	Sample[15] Description/Type	Date/Time[16] Collected	Container[17] Type	Sample[18] Volume	Pre-[19] servative	Requested Testing[20] Program	Condition on[21] Receipt	Disposal[22] Record No.
040193	Reactor sample	4-1-93	DeBO Tube 43	36 L Air	None	PAH Niosh Method 5506 3214	4076 AA3229	
032593	" "	3-25-93	"	36 L A.R	"	" " 3215	4077 AA3230	
041 93C	SN 12324 Air Sample	4-1-93	METAL CANISTER	1 CAN.	NONE	VOC EPA Method 8270 3216	4078 AA3231	
032593C	SN 12406 "	3-25-93	"	1 CAN.	NONE	" " 3217	4079 AA3232	

Special Instructions:[23]

Possible Hazard Identification:[24] Non-hazard ☑ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal:[25] Return to Client ☐ Disposal by Lab ☐ Archive ____ (mos.)

Turnaround Time Required:[26] Normal ☐ Rush ☐

QC Level:[27] I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by[28] (Signature/Affiliation) Tom Hendley	Date: 4-5-93 Time: 1500	1. Received by[28] (Signature/Affiliation) Julie Moore ITAS Ci	Date: 4/6/93 Time: 0830
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments:[29]

White: To accompany samples Yellow: Field copy

*See back of form for special instructions.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311399
Page 1 of 1

Project Name/No. [1] Weston / 580000.045 | Samples Shipment Date [7] 4-5-93 | Bill to: [5] 580000.041

Sample Team Members [2] T.Sohalk / J.Rishmayer | Lab Destination [8] ITAS Cincinnati

Profit Center No. [3] 3521

Lab Contact [9] Julie Moore

Project Manager [4] Kandi Brown | Project Contact/Phone [12] Kandi Brown 650-3211 | Report to: [10] K. Brown

Purchase Order No. [6]

Carrier/Waybill No. [13]

Required Report Date [11]

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Preservative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
040193	Reactor sample	4-1-93	DeBO Tube #3	36 L Air	None	PAH Niosh Method 5506	Sample received in good condition	
032593	" "	3-25-93	"	36 L Air	"	" "	Sample received in good condition	
04193C	Air Sample	4-1-93	Metal Canister	1 CAN.	None	VOC EPA Method 8270	Sample received in good condition	
032593C	" "	3-25-93	"	1 CAN.	None	" "	Sample received in good condition	
							4/6/93	
							[illegible]	

Special Instructions: [23]

Possible Hazard Identification: [24]
Non-hazard ☑ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required: [26]
Normal ☐ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify): _____

1. Relinquished by [28] (Signature/Affiliation) Tom Hendley	Date: 4-5-93 Time: 1500	1. Received by [28] (Signature/Affiliation) Julie Moore ITAS Ci	Date: 4/6/93 Time: 0930
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
304 Directors Drive
Knoxville, TN 37923

Date: April 28, 1993

Attn: Mr. Tim Schalk

Project Number 226

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston
Date Received:	March 8, 1993
Work Order:	234 (Re-issue)
Number of Samples:	8
Sample Type:	Air

I. Introduction

Eight samples arrived at ITAS Cincinnati on March 8, 1993. The samples were collected between February 11, 1993 through March 4, 1993 and were labeled as follows:

Tube # 21193	Canister # 21293C
Tube # 21793	Canister # 21893C
Tube # 22593	Canister # 22593C
Tube # 3493	Canister # 3493C

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. The data will include sample identification information, the analytical results, and the appropriate detection limits.

The analyses requested included Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry; EPA Method 8240 and Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry; EPA Method 8270.

Reviewed and Approved by:

Laurel Tomassoni
Project Manager
03234

Kevin Michlewicz, Ph.D
Systems Manager

III. Quality Control

Immediately following the analytical data for the samples can be found the QA/QC information that pertains to these samples. The purpose of this information is to demonstrate that the data enclosed is scientifically valid and defensible. This QA/QC data is used to assess the laboratory's performance during the analysis of the samples it accompanies. All quantitations were performed within the calibrated range of the analytical instrument.

IV. Data Report Qualifiers

Following are descriptions of data report qualifiers which may have been used in this analytical report.

J Indicates an estimated value. This flag is used when mass spectral data indicates the presence of the compound, but the result is less than the specified detection limit.

V. Comments

A interference with 1,3,5-trimethylbenzene made it difficult to confirm the the presence of the compound. Therefore, the detection limit has been elevated for samples 21293C and 22593C.

This report is being re-issued add two compounds.

Client: Weston
Work Order: 234
0323403

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Canister # 21293C

Lab Sample ID: AA1604

Analysis Date: March 16, 1993

Dilution Factor: 4.4

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		0.9
n-Pentane	1.1		2.2
1,1,2-Trichlorotrifluoroethane	ND		1.3
Methylene Chloride	28		0.9
Hexane	ND		1.8
1,1,1-Trichloroethane	3.8		1.3
Benzene	0.8	J	0.9
Toluene	1.6		0.9
n-Octane	0.4	J	0.9
Ethylbenzene	ND		0.9
m/p-Xylene	ND		0.9
o-Xylene	ND		0.9
n-Nonane	0.4	J	0.9
Styrene	ND		0.9
Cumene	ND		0.9
Decane	1.0		0.9
n-Undecane	1.3		0.9
n-Dodecane	1.0		0.9
1,3,5-Trimethylbenzene	ND		3
1,2,4-Trimethylbenzene	0.4	J	0.9
N-Heptane	ND		0.9

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323407

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Canister # 21893C

Lab Sample ID: AA1605

Analysis Date: March 16, 1993 & March 17, 1993

Dilution Factor: 7.3

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		1.5
n-Pentane	ND		3.7
1,1,2-Trichlorotrifluoroethane	ND		2.2
Methylene Chloride	180	(1)	8
Hexane	1.0	J	2.9
1,1,1-Trichloroethane	21		2.2
Benzene	0.8	J	1.5
Toluene	2.1		1.5
n-Octane	ND		1.5
Ethylbenzene	ND		1.5
m/p-Xylene	ND		1.5
o-Xylene	ND		1.5
n-Nonane	ND		1.5
Styrene	ND		1.5
Cumene	ND		1.5
Decane	0.9	J	1.5
n-Undecane	1.0	J	1.5
n-Dodecane	ND		1.5
1,3,5-Trimethylbenzene	ND		1.5
1,2,4-Trimethylbenzene	ND		1.5
N-Heptane	ND		1.5

ND = Not detected at or above the reported detection limit

(1) Dilution Factor = 40

Client: Weston
Work Order: 234
0323404

IT ANALYTICAL SERVICI
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Canister # 22593C

Lab Sample ID: AA1606

Analysis Date: March 16, 1993 & March 17, 1993

Dilution Factor: 4.1

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		0.8
n-Pentane	1.3		2.1
1,1,2-Trichlorotrifluoroethane	ND		1.2
Methylene Chloride	93	(1)	4
Hexane	0.5	J	1.6
1,1,1-Trichloroethane	120	(1)	6
Benzene	0.7	J	0.8
Toluene	2.4		0.8
n-Octane	ND		0.8
Ethylbenzene	ND		0.8
m/p-Xylene	0.5	J	0.8
o-Xylene	ND		0.8
n-Nonane	ND		0.8
Styrene	ND		0.8
Cumene	ND		0.8
Decane	0.5	J	0.8
n-Undecane	0.6	J	0.8
n-Dodecane	0.5	J	0.8
1,3,5-Trimethylbenzene	ND		2
1,2,4-Trimethylbenzene	ND		0.8
N-Heptane	ND		0.8

ND = Not detected at or above the reported detection limit

(1) Dilution Factor = 20

Client: Weston
Work Order: 234
0323402

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Canister # 3493C

Lab Sample ID: AA1607

Analysis Date: March 16, 1993 & March 17, 1993

Dilution Factor: 17.8

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		3.6
n-Pentane	ND		8.9
1,1,2-Trichlorotrifluoroethane	ND		5.3
Methylene Chloride	53		3.6
Hexane	2.0	J	7.1
1,1,1-Trichloroethane	200	(1)	50
Benzene	ND		3.6
Toluene	2.8	J	3.6
n-Octane	ND		3.6
Ethylbenzene	ND		3.6
m/p-Xylene	ND		3.6
o-Xylene	ND		3.6
n-Nonane	ND		3.6
Styrene	ND		3.6
Cumene	ND		3.6
Decane	ND		3.6
n-Undecane	ND		3.6
n-Dodecane	ND		3.6
1,3,5-Trimethylbenzene	ND		3.6
1,2,4-Trimethylbenzene	ND		3.6
N-Heptane	ND		3.6

ND = Not detected at or above the reported detection limit

(1) Dilution Factor = 168

Client: Weston
Work Order: 234
0323405

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank - ABLK01

Analysis Date: March 16, 1993

Dilution Factor: 1

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		0.2
n-Pentane	ND		0.5
1,1,2-Trichlorotrifluoroethane	ND		0.3
Methylene Chloride	ND		0.2
Hexane	ND		0.4
1,1,1-Trichloroethane	ND		0.3
Benzene	ND		0.2
Toluene	ND		0.2
n-Octane	ND		0.2
Ethylbenzene	ND		0.2
m/p-Xylene	ND		0.2
o-Xylene	ND		0.2
n-Nonane	ND		0.2
Styrene	ND		0.2
Cumene	ND		0.2
Decane	ND		0.2
n-Undecane	ND		0.2
n-Dodecane	ND		0.2
1,3,5-Trimethylbenzene	ND		0.2
1,2,4-Trimethylbenzene	ND		0.2
N-Heptane	ND		0.2

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323406

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank - ABLK02

Analysis Date: March 17, 1993

Dilution Factor: 1

COMPOUND	ppb	Q	Detection Limit
Chlorodifluoromethane	ND		0.2
n-Pentane	ND		0.5
1,1,2-Trichlorotrifluoroethane	ND		0.3
Methylene Chloride	ND		0.2
Hexane	ND		0.4
1,1,1-Trichloroethane	ND		0.3
Benzene	ND		0.2
Toluene	ND		0.2
n-Octane	ND		0.2
Ethylbenzene	ND		0.2
m/p-Xylene	ND		0.2
o-Xylene	ND		0.2
n-Nonane	ND		0.2
Styrene	ND		0.2
Cumene	ND		0.2
Decane	ND		0.2
n-Undecane	ND		0.2
n-Dodecane	ND		0.2
1,3,5-Trimethylbenzene	ND		0.2
1,2,4-Trimethylbenzene	ND		0.2
N-Heptane	ND		0.2

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323408

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Tube # 21193

Lab Sample ID: AA1600

Analysis Date: March 23, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Q	Detection Limit
Naphthalene	ND		10
2-Methylnaphthalene	ND		10
Acenaphthene	ND		10
Dibenzofuran	ND		10
Fluorene	ND		10
Dibenzo(a,h)anthracene	ND		10
Phenanthrene	ND		10
Anthracene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323409

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Tube # 21793

Lab Sample ID: AA1601

Analysis Date: March 23, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Q	Detection Limit
Naphthalene	ND		10
2-Methylnaphthalene	ND		10
Acenaphthene	ND		10
Dibenzofuran	ND		10
Fluorene	ND		10
Dibenzo(a,h)anthracene	ND		10
Phenanthrene	ND		10
Anthracene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323410

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Tube # 22593

Lab Sample ID: AA1602

Analysis Date: March 23, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Q	Detection Limit
Naphthalene	ND		10
2-Methylnaphthalene	ND		10
Acenaphthene	1	J	10
Dibenzofuran	ND		10
Fluorene	ND		10
Dibenzo(a,h)anthracene	ND		10
Phenanthrene	ND		10
Anthracene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323411

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Canister # 3493C

Lab Sample ID: AA1607

Analysis Date: March 23, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Q	Detection Limit
Naphthalene	ND		10
2-Methylnaphthalene	ND		10
Acenaphthene	2	J	10
Dibenzofuran	ND		10
Fluorene	ND		10
Dibenzo(a,h)anthracene	ND		10
Phenanthrene	ND		10
Anthracene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323412

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank

Analysis Date: March 23, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Q	Detection Limit
Naphthalene	ND		10
2-Methylnaphthalene	ND		10
Acenaphthene	ND		10
Dibenzofuran	ND		10
Fluorene	ND		10
Dibenzo(a,h)anthracene	ND		10
Phenanthrene	ND		10
Anthracene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 234
0323413

IT ANALYTICAL SERVICES
CINCINNATI, OH

Quality Assurance Data

Volatile
Surrogate Recovery, Percent

Client Sample ID	Lab No.	d4-1,2-Dichloroethane	d8-Toluene	p-Bromofluorobenzene
Canister # 21293C	AA1604	101	98	96
Canister # 21893C	AA1605	100	101	93
	AA1605 DL	103	100	99
Canister # 22593C	AA1606	98	100	94
	AA1606 DL	106	98	100
Canister # 3493C	AA1607	99	101	91
	AA1607 DL	105	100	101
Method Blank	ABLK01	99	100	98
Method Blank	ABLK02	100	100	99

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
304 Directors Drive
Knoxville, TN 37923

Date: May 14, 1993

Attn: K. Brown

Project Number 226

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston Air Project
Date Received:	April 23, 1993
Work Order:	628
Number of Samples:	5
Sample Type:	Air

I. Introduction

Five samples arrived at ITAS Cincinnati on April 23, 1993. The samples were collected between April 8, 1993 through April 21, 1993 and were labeled as follows:

Tube # 04893
Tube # 041793
Tube # 042193
Canister # 040993 C
Canister # 041693 C

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. The data will include sample identification information, the analytical results, and the appropriate detection limits.

The analyses requested and the methods used are listed on the following page.

Reviewed and Approved by:

Jon Sonderman
Project Manager
04628

II. Analytical Results/Methodology (cont.)

* PAH Semi-Volatile by Gas Chromatography/Mass Spectrometry; Modified NIOSH Method 5506

* Volatiles by Gas Chromatography/Mass Spectrometry; Method TO-14

III. Quality Control

Immediately following the analytical data for the samples can be found the QA/QC information that pertains to these samples. The purpose of this information is to demonstrate that the data enclosed is scientifically valid and defensible. This QA/QC data is used to assess the laboratory's performance during the analysis of the samples it accompanies. All quantitations were performed within the calibrated range of the analytical instrument.

IV. Data Report Qualifiers

Following are descriptions of data report qualifiers which may have been used in this analytical report.

J Indicates an estimated value. This flag is used when mass spectral data indicates the presence of the compound, but the result is less than the specified detection limit.

B This flag is used whenever the analyte is found in the blank as well as in the sample.

Client: Weston
Work Order: 628
0462802

IT ANALYTICAL SERVICI
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Tube # 04893

Lab Sample ID: AA4482

Analysis Date: April 12, 1993

Dilution Factor: 1

COMPOUND	ug/Tube		Detection Limit
Naphthalene	ND		10
2-Methylnaphthalene	ND		10
Acenaphthene	8	J	10
Dibenzofuran	3	J	10
Fluorene	3	J	10
Phenanthrene	ND		10
Anthracene	ND		10
Dibenz(a,h)anthracene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 628
0462803

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Tube # 041793

Lab Sample ID: AA4483

Analysis Date: April 12, 1993

Dilution Factor: 1

COMPOUND	ug/Tube		Detection Limit
Naphthalene	ND		10
2-Methylnaphthalene	ND		10
Acenaphthene	2	J	10
Dibenzofuran	ND		10
Fluorene	1	J	10
Phenanthrene	ND		10
Anthracene	ND		10
Dibenz(a,h)anthracene	ND		10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 628
0462804

IT ANALYTICAL SERVICI
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID: Tube # 042193

Lab Sample ID: AA4484

Analysis Date: April 12, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Detection Limit
Naphthalene	ND	10
2-Methylnaphthalene	ND	10
Acenaphthene	ND	10
Dibenzofuran	ND	10
Fluorene	ND	10
Phenanthrene	ND	10
Anthracene	ND	10
Dibenz(a,h)anthracene	ND	10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 628
0462805

IT ANALYTICAL SERVICES
CINCINNATI, OH

Semi-Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank - 477-CH2CL2

Analysis Date: April 12, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Detection Limit
Naphthalene	ND	10
2-Methylnaphthalene	ND	10
Acenaphthene	ND	10
Dibenzofuran	ND	10
Fluorene	ND	10
Phenanthrene	ND	10
Anthracene	ND	10
Dibenz(a,h)anthracene	ND	10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 628
0462806

IT ANALYTICAL SERVICI
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Can # 040993 C

Lab Sample ID: AA4485

Analysis Date: April 11, 1993 & April 13, 1993

Dilution Factor: 6.503

COMPOUND	ppbv		Detection Limit
Pentane	3.8		3.3
1,1,2-Trichlorotrifluoroethane	ND		2.0
Methylene Chloride	90	(1)	13
Hexane	1.8		1.3
Chlorodifluoromethane	ND		1.3
1,1,1-Trichloroethane	5.0		2.0
Benzene	1.5		1.3
n-Heptane	1.0		1.3
Toluene	3.8		1.3
n-Octane	ND		1.3
Ethyl Benzene	ND		1.3
m/p-Xylene	ND		1.3
Nonane	ND		1.3
o-Xylene	ND		1.3
Styrene	ND		1.3
Cumene	ND		1.3
1,3,5-Trimethylbenzene	ND		1.3
Decane	ND		1.3
1,2,4-Trimethylbenzene	ND		1.3
n-Undecane	ND		1.3
n-Dodecane	ND		1.3

ND = Not detected at or above the reported detection limit

(1) Dilution Factor = 65.03

SURROGATE RECOVERY	Percent Recovery	Dilution Percent Recovery
1,2-Dichloroethane-d4	100	98
Toluene-d8	100	102
4-Bromofluorobenzene	95	85

Client: Weston
Work Order: 628
0462807

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: Can # 041693 C

Lab Sample ID: AA4486

Analysis Date: April 11, 1993 & April 13, 1993

Dilution Factor: 39.59

COMPOUND	ppbv		Detection Limit
Pentane	ND		20
1,1,2-Trichlorotrifluoroethane	ND		12
Methylene Chloride	960	(1)	117
Hexane	ND		7.9
Chlorodifluoromethane	ND		7.9
1,1,1-Trichloroethane	ND		12
Benzene	ND		7.9
n-Heptane	ND		7.9
Toluene	ND		7.9
n-Octane	ND		7.9
Ethyl Benzene	ND		7.9
m/p-Xylene	ND		7.9
Nonane	ND		7.9
o-Xylene	ND		7.9
Styrene	ND		7.9
Cumene	ND		7.9
1,3,5-Trimethylbenzene	ND		7.9
Decane	ND		7.9
1,2,4-Trimethylbenzene	ND		7.9
n-Undecane	ND		7.9
n-Dodecane	ND		7.9

ND = Not detected at or above the reported detection limit

(1) Dilution Factor = 583.778

SURROGATE RECOVERY	Percent Recovery	Dilution Percent Recovery
1,2-Dichloroethane-d4	96	100
Toluene-d8	103	103
4-Bromofluorobenzene	90	86

Client: Weston
Work Order: 628
0462809

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank - ABLKX7

Analysis Date: April 11, 1993

Dilution Factor: 1

COMPOUND	ppbv	Detection Limit
Pentane	ND	0.5
1,1,2-Trichlorotrifluoroethane	ND	0.3
Methylene Chloride	ND	0.2
Hexane	ND	0.2
Chlorodifluoromethane	ND	0.2
1,1,1-Trichloroethane	ND	0.3
Benzene	ND	0.2
n-Heptane	ND	0.2
Toluene	ND	0.2
n-Octane	ND	0.2
Ethyl Benzene	ND	0.2
m/p-Xylene	ND	0.2
Nonane	ND	0.2
o-Xylene	ND	0.2
Styrene	ND	0.2
Cumene	ND	0.2
1,3,5-Trimethylbenzene	ND	0.2
Decane	ND	0.2
1,2,4-Trimethylbenzene	ND	0.2
n-Undecane	ND	0.2
n-Dodecane	ND	0.2

ND = Not detected at or above the reported detection limit

SURROGATE RECOVERY	Percent Recovery
1,2-Dichloroethane-d4	100
Toluene-d8	100
4-Bromofluorobenzene	95

Client: Weston
Work Order: 628
0462808

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank - ABLKY3

Analysis Date: April 13, 1993

Dilution Factor: 1

COMPOUND	ppbv	Detection Limit
Pentane	ND	0.5
1,1,2-Trichlorotrifluoroethane	ND	0.3
Methylene Chloride	ND	0.2
Hexane	ND	0.2
Chlorodifluoromethane	ND	0.2
1,1,1-Trichloroethane	ND	0.3
Benzene	ND	0.2
n-Heptane	ND	0.2
Toluene	ND	0.2
n-Octane	ND	0.2
Ethyl Benzene	ND	0.2
m/p-Xylene	ND	0.2
Nonane	ND	0.2
o-Xylene	ND	0.2
Styrene	ND	0.2
Cumene	ND	0.2
1,3,5-Trimethylbenzene	ND	0.2
Decane	ND	0.2
1,2,4-Trimethylbenzene	ND	0.2
n-Undecane	ND	0.2
n-Dodecane	ND	0.2

ND = Not detected at or above the reported detection limit

SURROGATE RECOVERY	Percent Recovery
1,2-Dichloroethane-d4	100
Toluene-d8	100
4-Bromofluorobenzene	92

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311325
Page 1 of ___

Project Name/No. [1] Weston/580000.045
Samples Shipment Date [7] 4/22/93
Bill to: [5] 580000.045

Sample Team Members [2] J. Rightmyer/T. Schalk
Lab Destination [8] ITAS Cincinnati

Profit Center No. [3] 3521
Lab Contact [9] Julie Moore

Project Manager [4] Kandi Brown
Project Contact/Phone [12] Kandi Brown/610-3211
Report to: [10] K. Brown

Purchase Order No. [6]
Carrier/Waybill No. [13]

Required Report Date [11]

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Pre-servative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
04893	Reactor air sample from 4/7 to 4/8	4/8/93	orbo-43 tube	36L of air	None	PAH NIOSH Method 5506	Samples recd in good	
041793 ~~041993~~ JR	Reactor air sample from 4/16 to 4/17	4/~~19~~ 17 JR /93	orbo-43 tube	36L of air	None	PAH NIOSH Method 5506	condition at [illegible]	
042193	Reactor air sample from 4/20 to 4/21	4/21/93	orbo-43 tube	36L of air	None	PAH NIOSH Method 5506	temp [illegible]	
							[illegible] on [illegible] case.	
040993 C	Reactor air sample	4/9/93	metal canister	1 canister	None	VOC EPA method 8270	-SN 12825 [illegible] 4/23/93	
041693 C	Reactor air sample	4/16/93	metal canister	1 canister	None	VOC EPA method 8270	-SN 12826 [illegible]	

Special Instructions: [23]

Possible Hazard Identification: [24]
Non-hazard ☑ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☐ Archive ___ (mos.)

Turnaround Time Required: [26]
Normal ☐ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify): ___

1. Relinquished by [28] (Signature/Affiliation) Janet Rightmyer	Date: 4/22/93 Time: 9:45 am	1. Received by [28] (Signature/Affiliation) Nicholas W. Plummer ITAS-Ci	Date: 4/23/93 Time: 09:35
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923

Date: June 2, 1993

Attn: Kandi Brown

Project Number 226

This is the Certificate of Analysis for the following samples:

Client Project ID:	Weston Air Project
Date Received:	May 6, 1993
Work Order:	733
Number of Samples:	3
Sample Type:	Air

I. Introduction

Three samples arrived at ITAS Cincinnati on May 6, 1993. The samples were collected on May 22, 1993 and May 29, 1993 and were labeled as follows:

Tube # 042893
* Canister # 042293C
* Canister # 042993C

* These samples were analyzed by Air Toxics LTD. under ITAS Subcontract.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. The data will include sample identification information, the analytical results, and the appropriate detection limits.

The analyses requested and the methods used are listed on the following page.

Reviewed and Approved by:

Jon Sonderman
Project Manager
05733

II. Analytical Results/Methodology (cont.)

* PAH Semi-Volatile by Gas Chromatography/Mass Spectrometry; Modified NIOSH Method 5506

* Volatiles by Gas Chromatography/Mass Spectrometry; Method TO-14

III. Quality Control

Immediately following the analytical data for the samples can be found the QA/QC information that pertains to these samples. The purpose of this information is to demonstrate that the data enclosed is scientifically valid and defensible. This QA/QC data is used to assess the laboratory's performance during the analysis of the samples it accompanies. All quantitations were performed within the calibrated range of the analytical instrument.

IV. Data Report Qualifiers

Following are descriptions of data report qualifiers which may have been used in this analytical report.

J Indicates an estimated value. This flag is used when mass spectral data indicates the presence of the compound, but the result is less than the specified detection limit.

B This flag is used whenever the analyte is found in the blank as well as in the sample.

Client: Weston
Work Order: 733
0573305

IT ANALYTICAL SERVICES
CINCINNATI, OH

PAH Semivolatile Organic Compounds

Client Sample ID: 042893

Lab Sample ID: AA5340

Analysis Date: May 12, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Detection Limit
Naphthalene	ND	10
2-Methylnaphthalene	ND	10
Acenaphthene	ND	10
Dibenzofuran	ND	10
Fluorene	ND	10
Phenanthrene	ND	10
Anthracene	ND	10
Dibenzo(a,h)anthracene	ND	10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 733
0573306

IT ANALYTICAL SERVICI
CINCINNATI, OH

PAH Semivolatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank - CH2CL2 BLK

Analysis Date: May 12, 1993

Dilution Factor: 1

COMPOUND	ug/Tube	Detection Limit
Naphthalene	ND	10
2-Methylnaphthalene	ND	10
Acenaphthene	ND	10
Dibenzofuran	ND	10
Fluorene	ND	10
Phenanthrene	ND	10
Anthracene	ND	10
Dibenzo(a,h)anthracene	ND	10

ND = Not detected at or above the reported detection limit

Client: Weston
Work Order: 733
0573302

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: 042293C

Lab Sample ID: AA5341

Analysis Date: May 28, 1993

Dilution Factor: 3.9

COMPOUND	ppbv	Detection Limit
Ethylbenzene	ND	2.0
Styrene	ND	2.0
1,3,5-Trimethylbenzene	ND	2.0
Toluene	4.2	2.0
Nonane	ND	2.0
Benzene	ND	2.0
Methylene Chloride	24	2.0
1,1,1-Trichloroethane	7.4	2.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0
o-Xylene	ND	2.0
1,2,4-Trimethylbenzene	ND	2.0
m/p-Xylene	ND	2.0
Chlorodifluoromethane	ND	2.0
n-Pentane	2.0	2.0
n-Hexane	ND	2.0
n-Octane	ND	2.0
Cumene	ND	2.0
n-Decane	ND	2.0
n-Undecane	ND	2.0
n-Dodecane	ND	2.0
n-Heptane	ND	2.0

ND = Not detected at or above the reported detection limit

% Recovery	
Octafluorotoluene	127
Toluene-d8	99
4-Bromofluorobenzene	89

Client: Weston
Work Order: 733
0573303

IT ANALYTICAL SERVICI
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID: 042993C

Lab Sample ID: AA5342

Analysis Date: May 28, 1993

Dilution Factor: 4.0

COMPOUND	ppbv	Detection Limit
Ethylbenzene	ND	2.0
Styrene	ND	2.0
1,3,5-Trimethylbenzene	ND	2.0
Toluene	4.1	2.0
Nonane	ND	2.0
Benzene	ND	2.0
Methylene Chloride	14	2.0
1,1,1-Trichloroethane	13	2.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0
o-Xylene	ND	2.0
1,2,4-Trimethylbenzene	ND	2.0
m/p-Xylene	ND	2.0
Chlorodifluoromethane	ND	2.0
n-Pentane	2.0	2.0
n-Hexane	ND	2.0
n-Octane	ND	2.0
Cumene	ND	2.0
n-Decane	ND	2.0
n-Undecane	ND	2.0
n-Dodecane	ND	2.0
n-Heptane	ND	2.0

ND = Not detected at or above the reported detection limit

% Recovery	
Octafluorotoluene	126
Toluene-d8	97
4-Bromofluorobenzene	86

Client: Weston
Work Order: 733
0573304

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organic Compounds

Client Sample ID:

Lab Sample ID: Method Blank

Analysis Date: May 28, 1993

Dilution Factor: 1

COMPOUND	ppbv	Detection Limit
Ethylbenzene	ND	0.5
Styrene	ND	0.5
1,3,5-Trimethylbenzene	ND	0.5
Toluene	ND	0.5
Nonane	ND	0.5
Benzene	ND	0.5
Methylene Chloride	ND	0.5
1,1,1-Trichloroethane	ND	0.5
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	0.5
o-Xylene	ND	0.5
1,2,4-Trimethylbenzene	ND	0.5
m/p-Xylene	ND	0.5
Chlorodifluoromethane	ND	0.5
n-Pentane	ND	0.5
n-Hexane	ND	0.5
n-Octane	ND	0.5
Cumene	ND	0.5
n-Decane	ND	0.5
n-Undecane	ND	0.5
n-Dodecane	ND	0.5
n-Heptane	ND	0.5

ND = Not detected at or above the reported detection limit

% Recovery	
Octafluorotoluene	108
Toluene-d8	116
4-Bromofluorobenzene	73

W733

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311336
Page 1 of ___

Project Name/No.[1] Weston / 580000.045
Sample Team Members[2] J. Rightmyer
Profit Center No.[3] 3521
Project Manager[4] K. Brown
Purchase Order No.[6]
Required Report Date[11]

Samples Shipment Date[7] 5/5/93
Lab Destination[8] ITAS Cincinnati
Lab Contact[9] Julie Moore
Project Contact/Phone[12] Kandi Brown / 690-3211
Carrier/Waybill No.[13]

Bill to:[5] 580000.045
Report to:[10] K. Brown
312 Directors Dr
Knoxville, TN 37923

White: To accompany samples
Yellow: Field copy

ONE CONTAINER PER LINE

Sample Number[14]	Sample Description/Type[15]	Date/Time Collected[16]	Container Type[17]	Sample Volume[18]	Preservative[19]	Requested Testing Program[20]	Condition on Receipt[21]	Disposal Record No.[22]
042293	Reactor air sample from 4/23 to 4/29/93	4/29/93	Orbo-43 tube	36L of air	None	PAH NIOSH Method 5506	Samples Received in good condition COC seals were not attached Kl 5/6	
042293C	Reactor air sample	24-hour 4/22/93	metal canister	24 hour canister	None	This sample was collected for 24 hrs. VOC EPA Method 8270		
042993C	Reactor air sample	8-hour 11/29/93	metal canister	8 hour canister	None	VOC EPA METHOD 8270		

Special Instructions:[23] W720

Possible Hazard Identification:[24] Non-hazard ☑ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal:[25] Return to Client ☐ Disposal by Lab ☐ Archive (mos.)

Turnaround Time Required:[26] Normal ☐ Rush ☐

QC Level:[27] I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by[28] (Signature/Affiliation) Janet Rightmyer — Date: 5/5/93 Time: 11:00 am	1. Received by[28] (Signature/Affiliation) K Cattle ITAS Cin — Date: 5/6/93 Time: 0925
2. Relinquished by (Signature/Affiliation) — Date: Time:	2. Received by (Signature/Affiliation) — Date: Time:
3. Relinquished by (Signature/Affiliation) — Date: Time:	3. Received by (Signature/Affiliation) — Date: Time:

Comments:[29]

*See back of form for special instructions.

Flow Controller Calibration Sheet

SDV - 00183

Client: IT - Knoxville **W.O. #** _____ **Date:** 4/16/93

Total Fill Time: 6 HRS. **Fill Rate:** 12.5 ± 0.5 cc/min.

# 45 : 12.89 12.81 12.79	# _____ :	# _____ :
# _____ :	# _____ :	# _____ :
# _____ :	# _____ :	# _____ :
# _____ :	# _____ :	# _____ :
# _____ :	# _____ :	# _____ :
# _____ :	# _____ :	# _____ :
# _____ :	# _____ :	# _____ :
# _____ :	# _____ :	# _____ :
# _____ :	# _____ :	# _____ :
# _____ :	# _____ :	# _____ :

WO 733

ASTM Method D 422

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

Kandi Brown
IT Corporation
312 Directors Drive
Knoxville, TN 37931

May 10, 1993

ETDC Project Number: 483500.068.01 **P.O. Number:** BAC02
Job Number: 580000.045

This is the Certificate of Analysis for the following samples:

Client Project ID:	**WESTON**
Date Received by Lab:	**2/1/93 THROUGH 4/5/93**
Number of Samples:	**Ten (10)**
Sample Type:	**SOIL**

I. Introduction/Case Narrative

Ten soil samples were received by IT/ETDC from February through April of 1993 for analysis of particle size distribution.

Please see Appendix A, the Sample Number Cross Reference List; Appendix B, the Analysis Results; and Appendix C, the Chain of Custody and Request for Analysis Records.

Reviewed and Approved:

Beverly L. Leamon
Project Manager, Geotechnical Services

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II. Analytical Results/Methodology

REFERENCES: Annual Book of ASTM Standards, Section 4, Construction, Volume 04.08, Soil and Rock; Dimension Stone; Geosynthetics.

Particle Size Distribution ASTM D 422

III. Quality Control

Quality control checks such as duplicates and spikes (QC samples), are not normally applicable to geotechnical testing. This is due to the inability of obtaining samples with known characteristics, the heterogenous nature of the samples, and Quality Control procedures built-in to the analytical method.

QC measures to ensure accuracy and precision of test results include the following:

- 100% verification on all numerical results - all raw data entries, transcriptions and calculations entered by lab technicians are checked, recalculated and verified. Most data calculations are performed by computer programs.
- Data validation through test reasonableness - summaries of all test results for individual reports are reviewed to determine the overall reasonableness of data and to determine the presence of any data that may be considered outliers.
- Quality control procedures are built into most standardized geotechnical procedures. For example, many analyses routinely call for a re-analysis, specifying an acceptance criteria.
- Routine instrument calibration - all instruments, gauges and equipment used in testing are calibrated on a routine basis. All instrument calibration follows ASTM or manufacturer guidelines.
- Maintenance of all past calibration records - records and certification documents of all instruments, gauges and equipment are updated routinely and maintained in the Quality Control Coordinators Quality/Operations files.

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- Use of trained personnel for conducting tests - all technicians are trained in the application of standard laboratory procedures for geotechnical analyses as well as the quality assurance measures implemented by IT.

IV. Data Qualification

Fine sieve and hydrometer results occasionally overlap due to organic debris, soluble salts or other contaminants contained in the sample. Data points are plotted as calculated. No attempt has been made to curve-fit the grainsize data points.

Appendix A

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May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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CROSS-REFERENCE LIST

ETDC SAMPLE NO.	CLIENT SAMPLE NO.
ETDC-3226	WAS1/29/93
ETDC-3227	WAS12/04/93
ETDC-3286	WAS2/11/93
ETDC-3326	WAS2/18/93
ETDC-3327	WAS2/25/93
ETDC-3328	WAS3/04/93
ETDC-3330	WAS3/11/93
ETDC-3337	WAS3/18/93
ETDC-3352	WAS3/25/93
ETDC-3365	WAS4/02/93

Appendix B

Kandi Brown
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May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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PARTICLE SIZE ANALYSIS
ASTM D 422

Project Name: WESTON

Client Number: WAS1/29/93

Project Number: 483500.068.01

ETDC Number: ETDC- 3226

Specific Gravity =	2.6500 Assumed

Moisture Content =	121.4%

SIEVE ANALYSIS

COARSE

Sieve No.	Diameter mm	Percent Finer
3"	75.000	100.0%
1.5"	37.500	100.0%
0.75"	19.000	100.0%
0.375"	9.500	100.0%
#4	4.750	100.0%
#10	2.000	100.0%

FINE

Sieve No.	Diameter mm	Percent Finer
#20	0.850	99.8%
#40	0.425	96.6%
#60	0.250	89.9%
#100	0.149	
#140	0.106	81.1%
#200	0.075	78.8%

HYDROMETER ANALYSIS

HYDROMETER

Diameter mm	Percent Finer
0.06118	52.9%
0.04457	47.6%
0.03197	44.5%
0.02096	36.8%
0.01262	27.6%
0.00910	23.0%
0.00656	18.4%
0.00463	15.3%
0.00331	13.0%
0.00081	5.4%

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May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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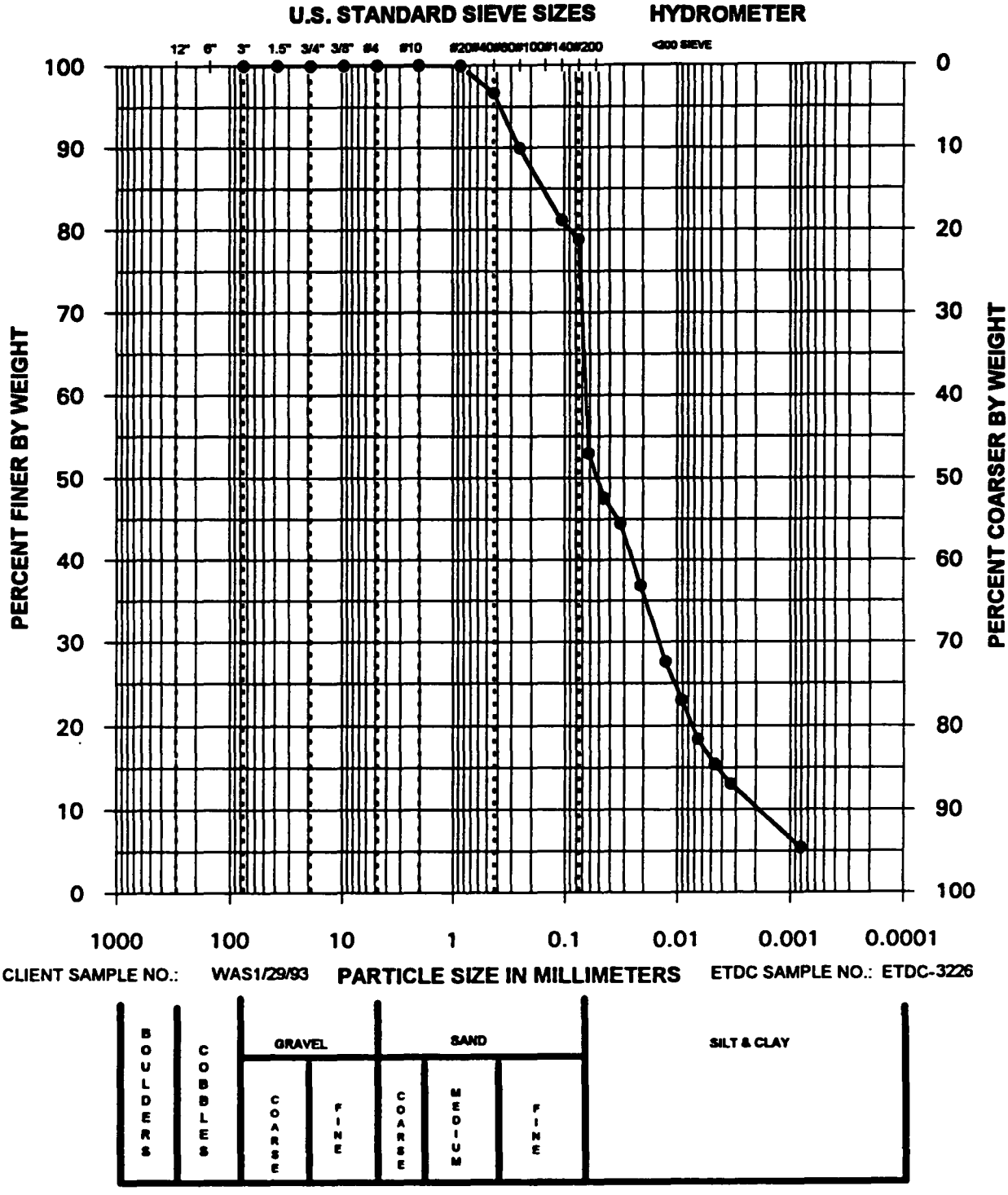

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Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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PARTICLE SIZE ANALYSIS
ASTM D 422

Project Name:	WESTON	Client Number:	WAS2/4/93
Project Number:	483500.068.01	ETDC Number:	ETDC- 3227

Specific Gravity =	2.6500 Assumed

Moisture Content =	175.0%

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	95.6%
	#40	0.425	89.3%
	#60	0.250	76.9%
	#100	0.149	65.8%
	#140	0.106	60.7%
	#200	0.075	57.3%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER	0.06761	44.6%
	0.04802	42.8%
	0.03471	37.7%
	0.02242	32.6%
	0.01346	22.3%
	0.00963	18.8%
	0.00688	15.4%
	0.00495	10.3%
	0.00353	8.6%
	0.00146	4.3%

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Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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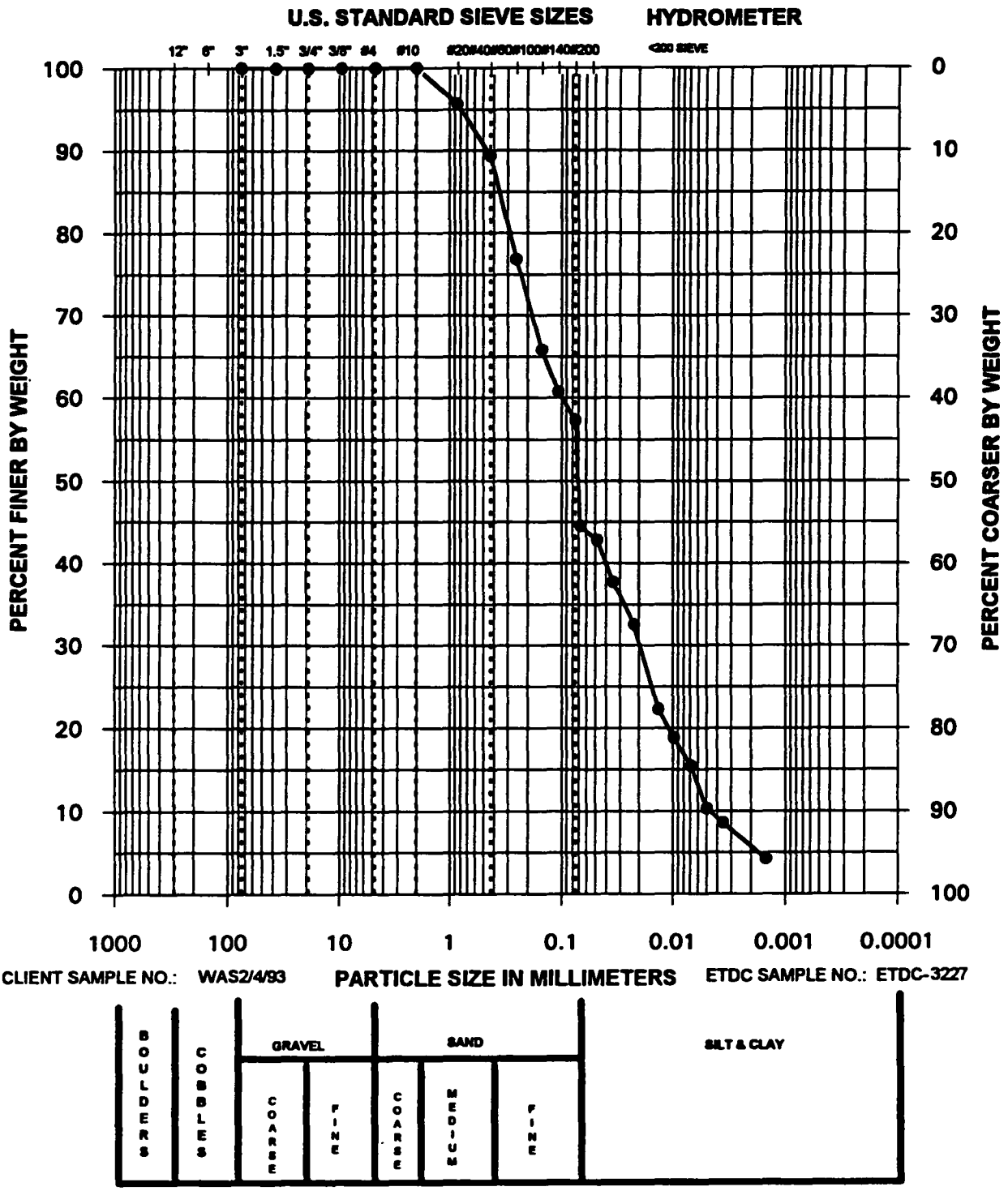

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Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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PARTICLE SIZE ANALYSIS
ASTM D 422

Project Name:	WESTON	Client Number:	WAS2/11/93
Project Number:	483500.068.01	ETDC Number:	ETDC- 3286

Specific Gravity =	2.6500 Assumed

Moisture Content =	150.9%

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.9%
	#40	0.425	97.1%
	#60	0.250	88.3%
	#100	0.149	78.6%
	#140	0.106	74.2%
	#200	0.075	72.1%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.03184	49.1%
	0.02073	43.0%
	0.01278	32.2%
	0.00924	26.9%
	0.00665	23.0%
	0.00472	18.4%
	0.00339	15.4%
	0.00143	10.0%

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Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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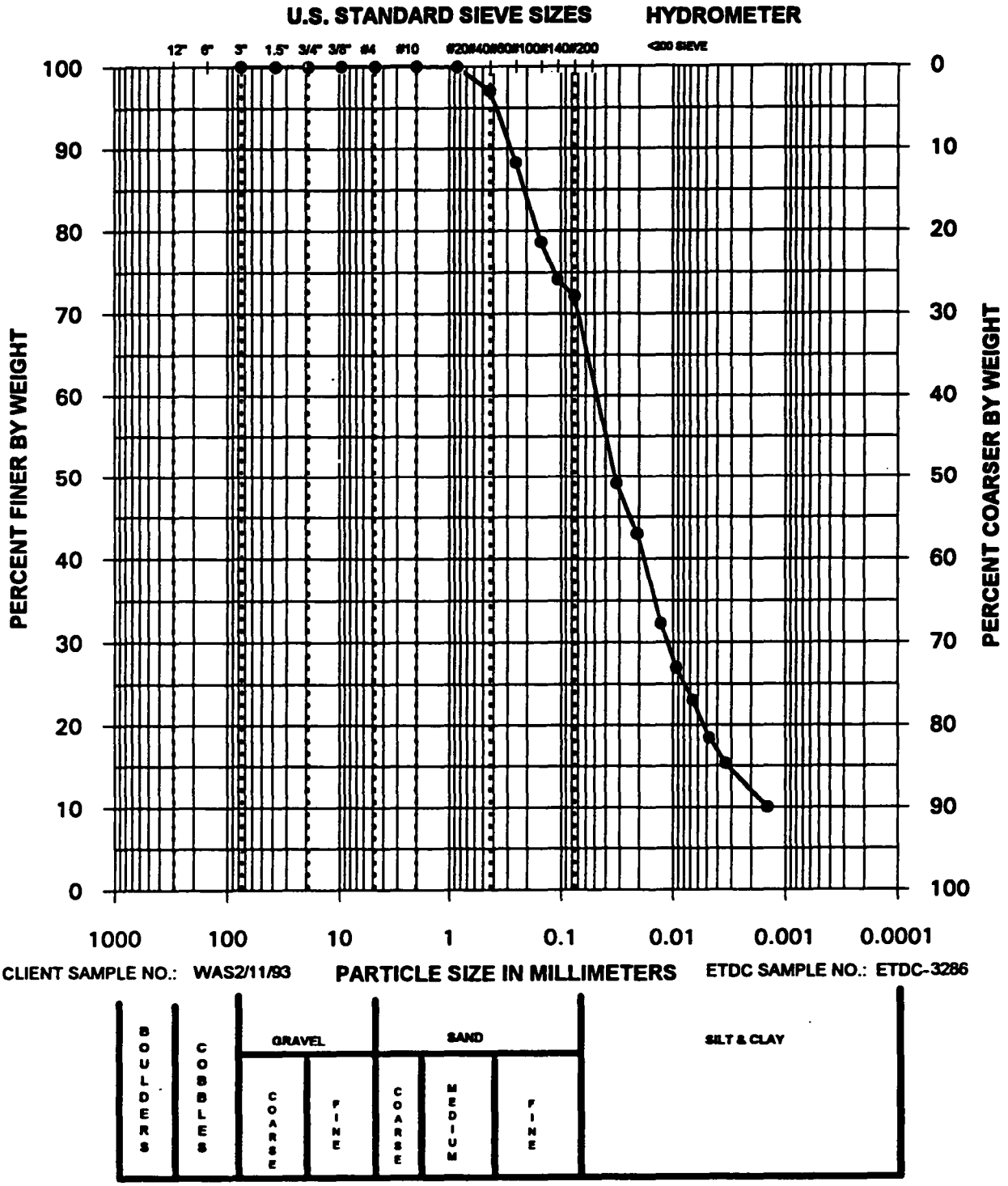

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May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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PARTICLE SIZE ANALYSIS
ASTM D 422

Project Name:	WESTON	Client Number:	WAS2/18/93
Project Number:	483500.068.01	ETDC Number:	ETDC- 3326

Specific Gravity =	2.6500 Assumed

Moisture Content =	174.4%

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	97.5%
	#60	0.250	89.6%
	#100	0.149	80.6%
	#140	0.106	75.4%
	#200	0.075	71.3%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.03295	54.0%
	0.02158	45.9%
	0.01292	36.0%
	0.00948	27.0%
	0.00683	20.7%
	0.00486	17.1%
	0.00349	12.6%
	0.00142	5.4%

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IT Corporation
May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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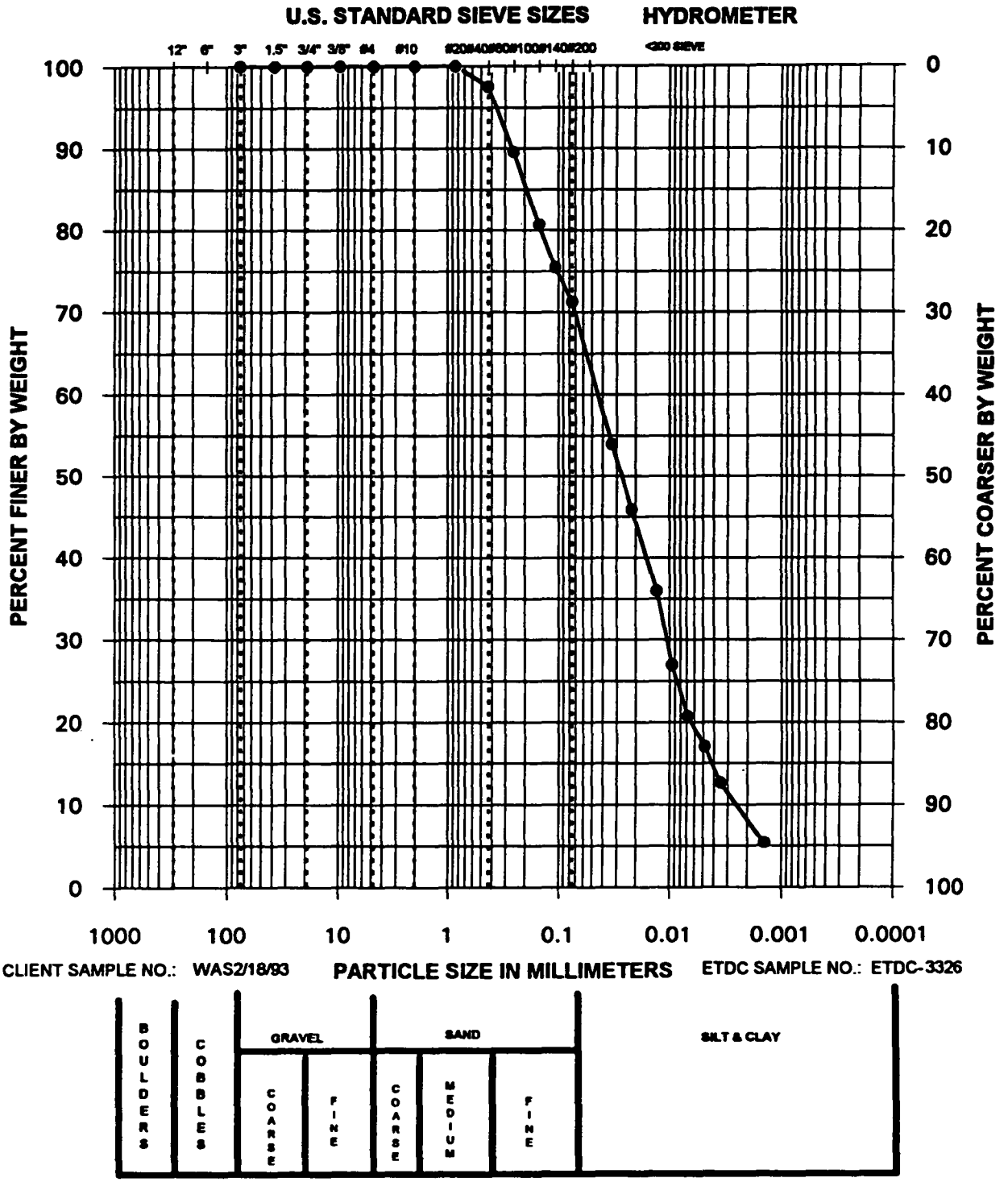

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May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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PARTICLE SIZE ANALYSIS
ASTM D 422

Project Name: WESTON
Client Number: WAS2/25/93

Project Number: 483500.068.01
ETDC Number: ETDC- 3327

Specific Gravity =	2.6500 Assumed

Moisture Content =	177.3%

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	97.4%
	#60	0.250	89.1%
	#100	0.149	79.6%
	#140	0.106	74.3%
	#200	0.075	70.3%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.03247	58.5%
	0.02153	47.5%
	0.01319	31.1%
	0.00949	26.5%
	0.00674	22.8%
	0.00486	17.4%
	0.00349	12.8%
	0.00142	6.4%

Kandi Brown
IT Corporation
May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

IT ANALYTICAL SERVICE
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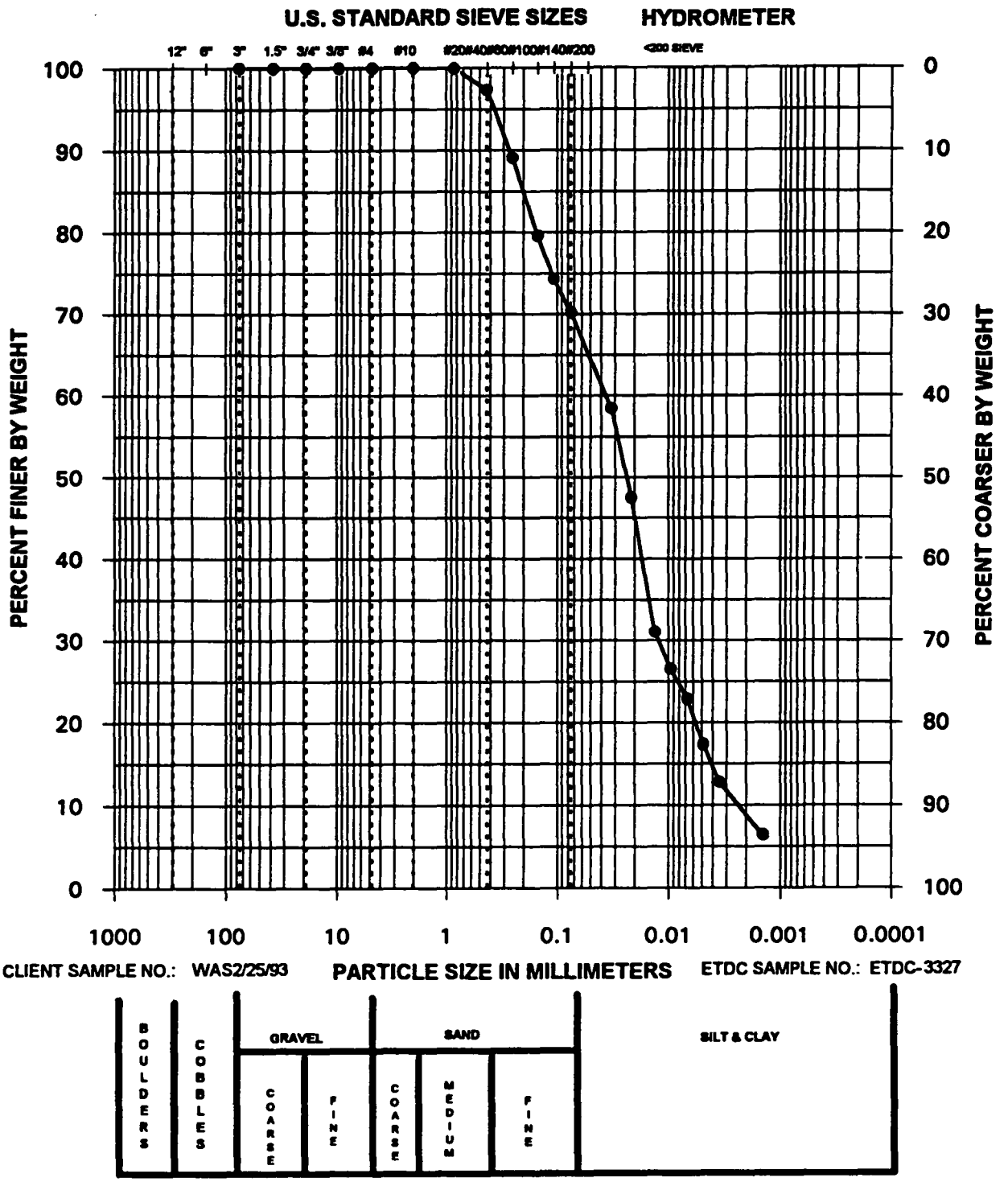

Kandi Brown
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May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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PARTICLE SIZE ANALYSIS
ASTM D 422

Project Name:	WESTON	Client Number:	WAS3/4/93
Project Number:	483500.068.01	ETDC Number:	ETDC- 3328

Specific Gravity =	2.6500 Assumed

Moisture Content =	168.8%

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	97.0%
	#60	0.250	87.9%
	#100	0.149	77.9%
	#140	0.106	72.8%
	#200	0.075	68.9%

HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.04547	59.9%
	0.03295	54.4%
	0.02191	41.7%
	0.01290	37.2%
	0.00951	25.4%
	0.00681	20.0%
	0.00487	16.3%
	0.00348	11.8%
	0.00143	5.4%

Kandi Brown
IT Corporation
May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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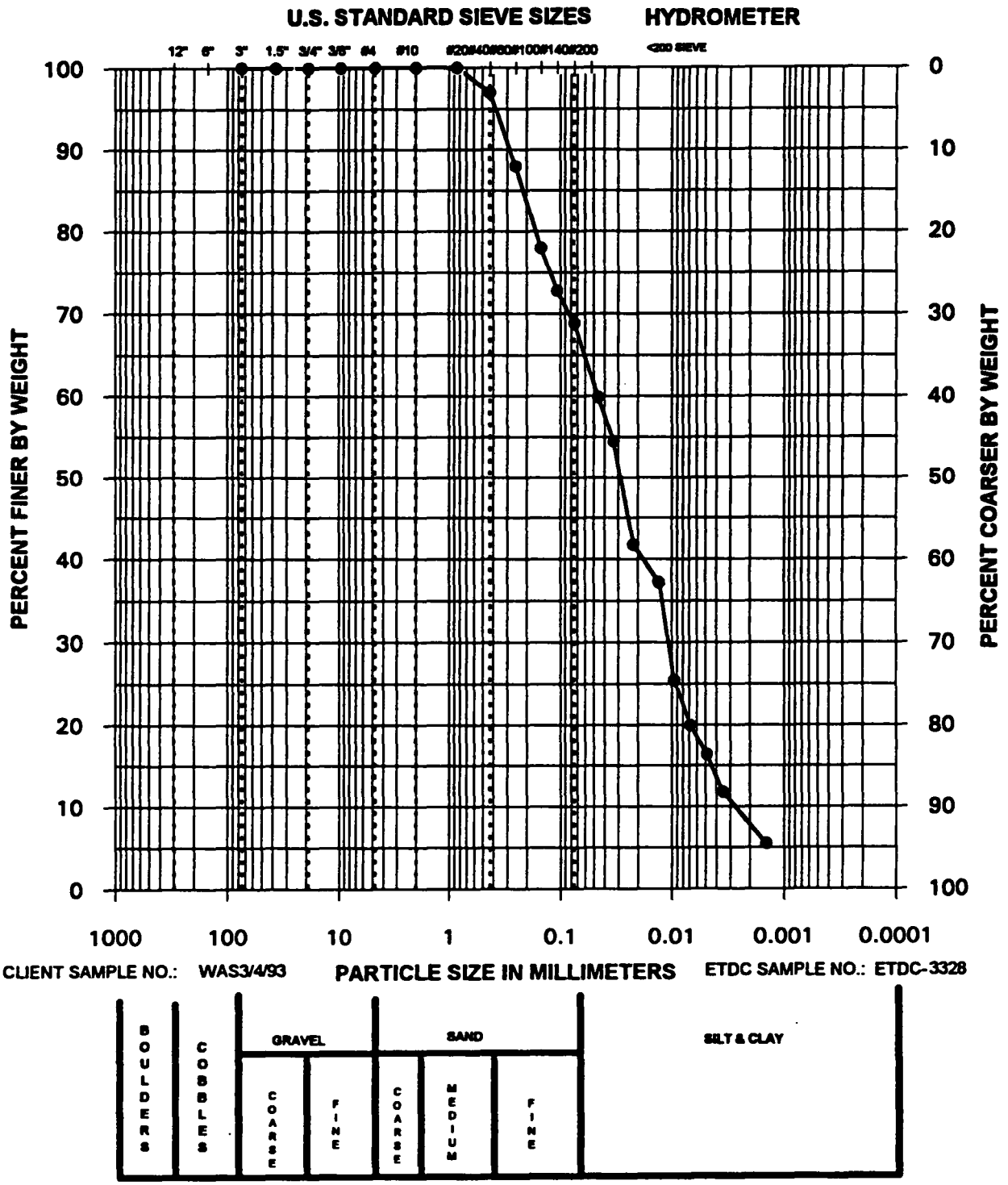
WESTON



Kandi Brown
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May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

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PARTICLE SIZE ANALYSIS
ASTM D 422

Project Name: WESTON
Client Number: WAS3/11/93

Project Number: 483500.068.01
ETDC Number: ETDC- 3330

Specific Gravity =	2.6500 Assumed

Moisture Content =	156.3%

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.9%
	#40	0.425	97.0%
	#60	0.250	88.4%
	#100	0.149	79.0%
	#140	0.106	74.2%
	#200	0.075	70.4%

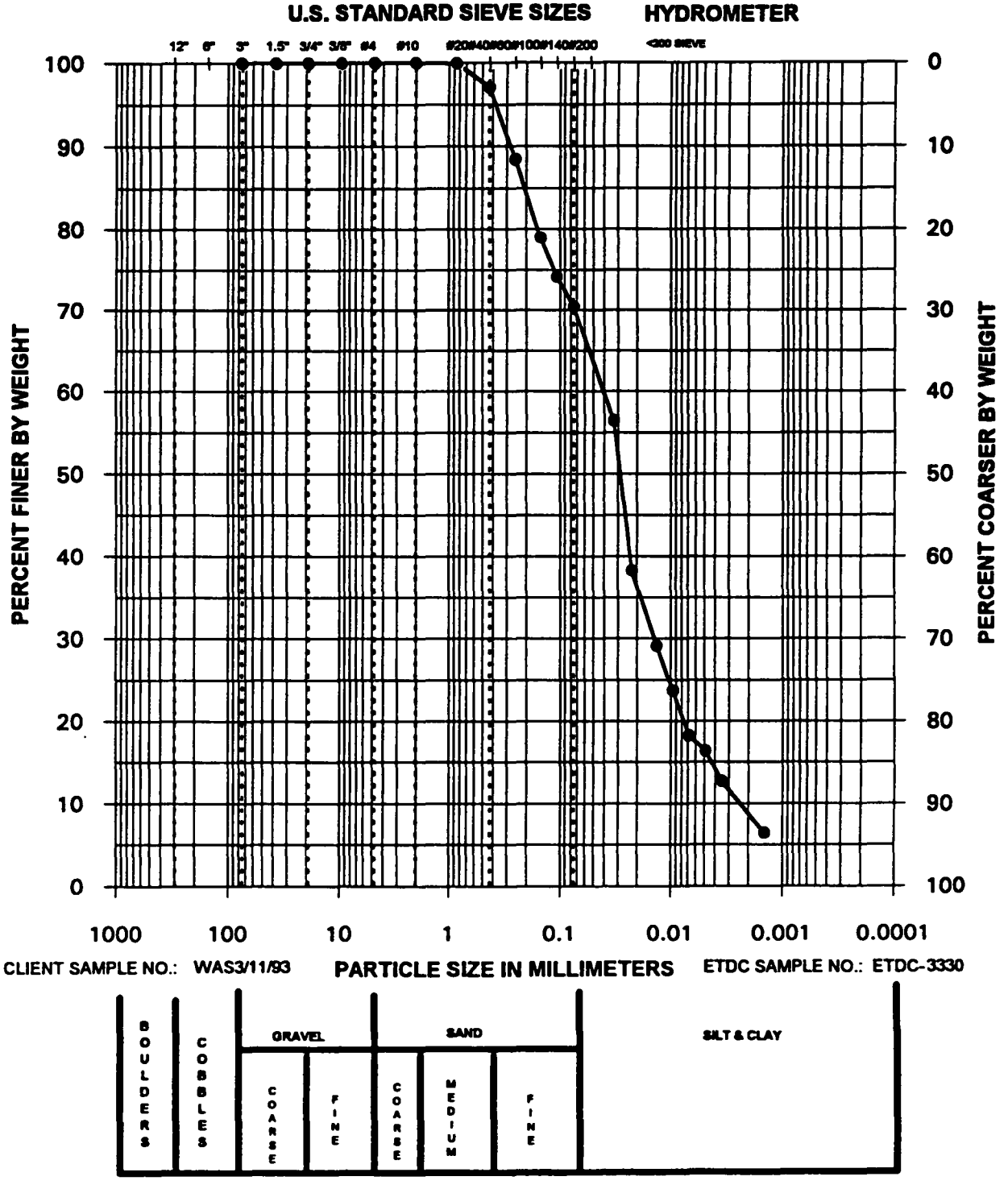
HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.03263	56.5%
	0.02229	38.3%
	0.01330	29.1%
	0.00959	23.7%
	0.00686	18.2%
	0.00487	16.4%
	0.00349	12.8%
	0.00143	6.4%

Kandi Brown
IT Corporation
May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

IT ANALYTICAL SERVICE
KINGSTON, TN
(615) 482-6497

WESTON



Kandi Brown
IT Corporation
May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

IT ANALYTICAL SERVICES
KINGSTON, TN
(615) 482-6497

PARTICLE SIZE ANALYSIS
ASTM D 422

Project Name: WESTON
Client Number: WAS3/18/93

Project Number: 483500.068.01
ETDC Number: ETDC- 3337

Specific Gravity =	2.6500 Assumed

Moisture Content =	155.9%

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	97.4%
	#60	0.250	89.3%
	#100	0.149	80.4%
	#140	0.106	75.6%
	#200	0.075	71.7%

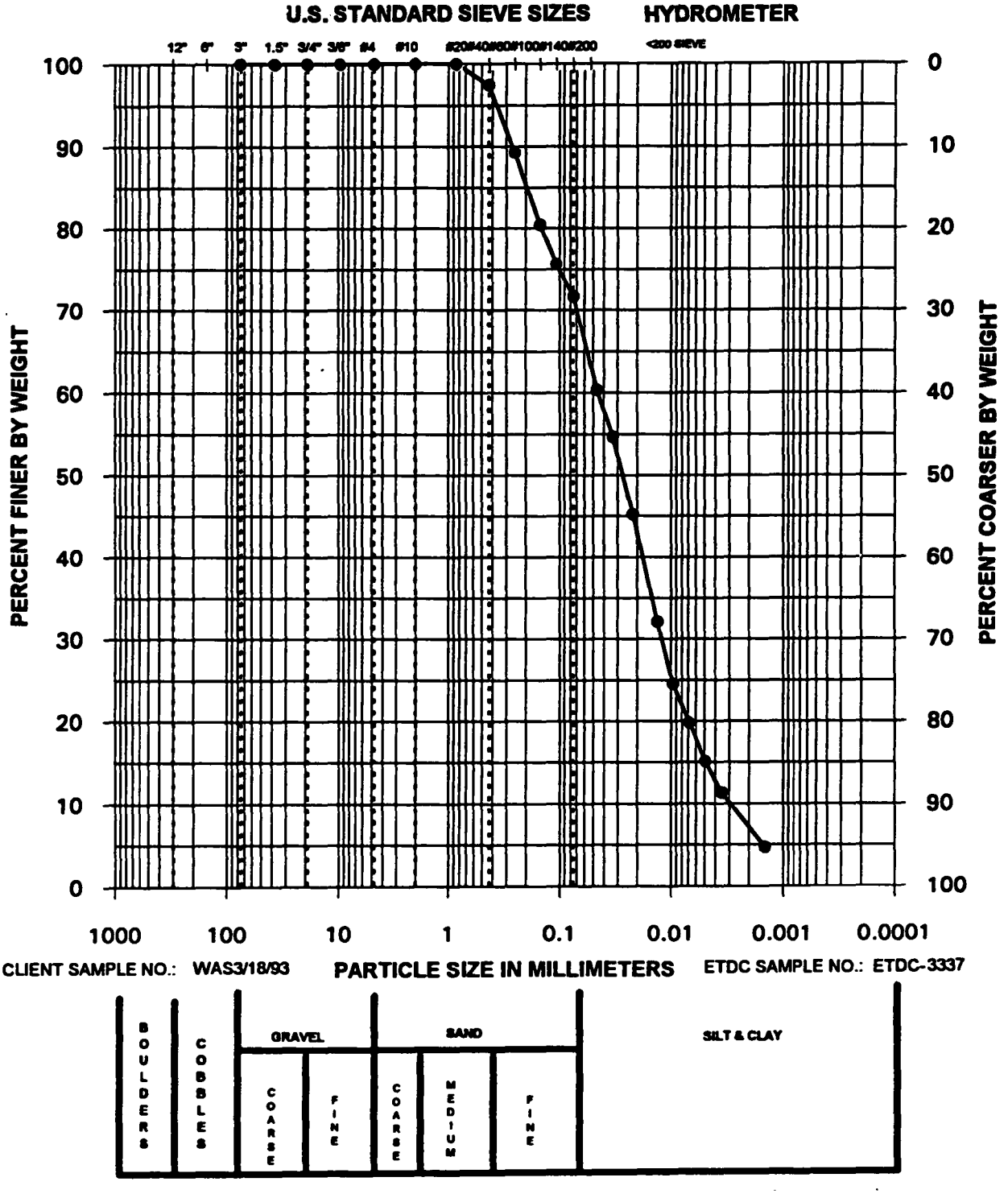
HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.04592	60.3%
	0.03327	54.7%
	0.02182	45.3%
	0.01319	32.1%
	0.00959	24.5%
	0.00683	19.8%
	0.00490	15.1%
	0.00350	11.3%
	0.00144	4.7%

Kandi Brown
IT Corporation
May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

IT ANALYTICAL SERVIC
KINGSTON, TN
(615) 482-6497

WESTON



Kandi Brown
IT Corporation
May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

IT ANALYTICAL SERVICES
KINGSTON, TN
(615) 482-6497

PARTICLE SIZE ANALYSIS
ASTM D 422

Project Name: WESTON
Client Number: WAS3/25/93

Project Number: 483500.068.01
ETDC Number: ETDC- 3352

Specific Gravity =	2.6500 Assumed

Moisture Content =	160.0%

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	99.8%
	#40	0.425	95.8%
	#60	0.250	84.6%
	#100	0.149	74.2%
	#140	0.106	68.0%
	#200	0.075	63.0%

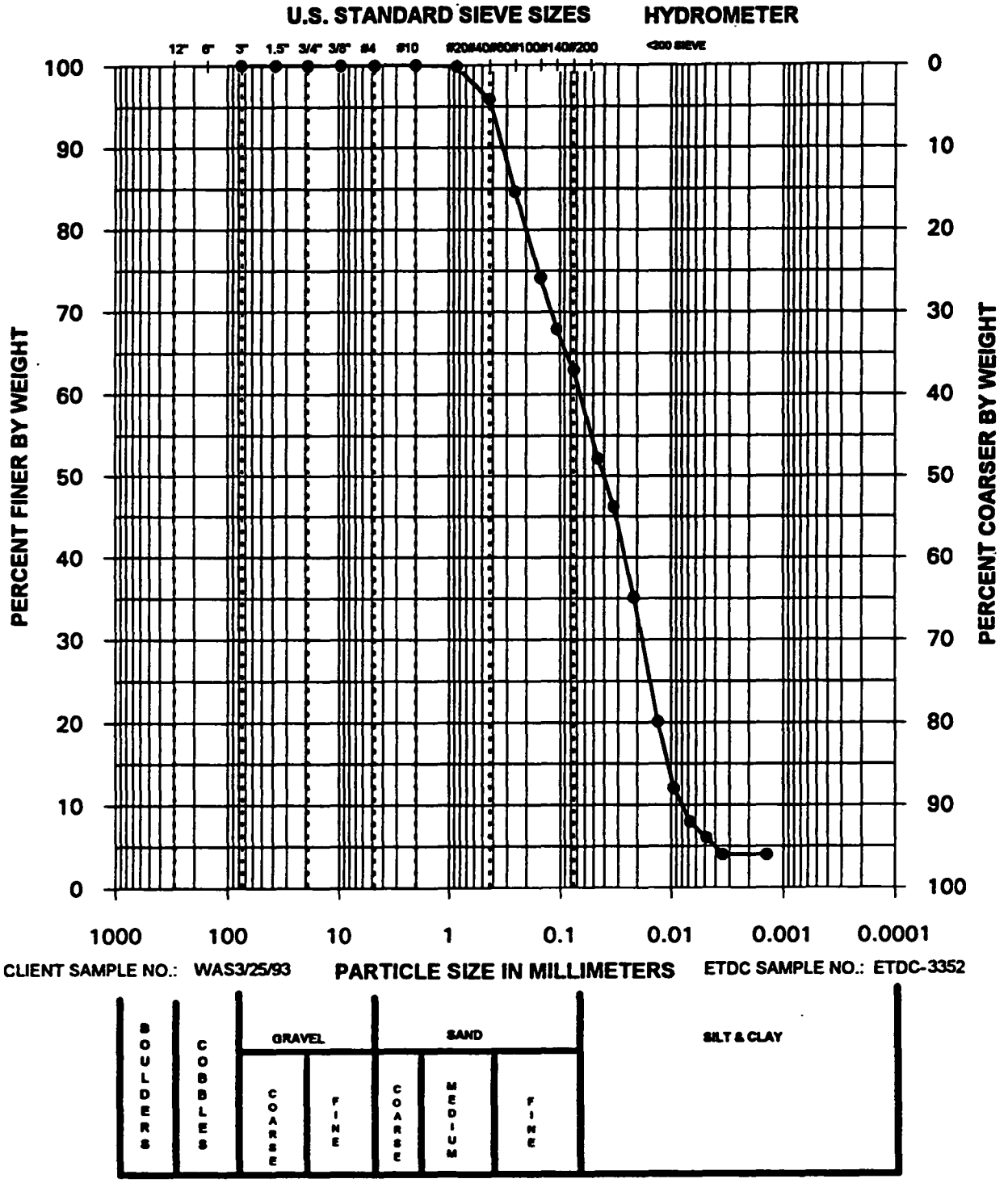
HYDROMETER ANALYSIS

HYDROMETER	Diameter mm	Percent Finer
	0.04548	52.1%
	0.03273	46.1%
	0.02154	35.1%
	0.01305	20.1%
	0.00942	12.0%
	0.00676	8.0%
	0.00479	6.0%
	0.00341	4.0%
	0.00141	4.0%

Kandi Brown
IT Corporation
May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

IT ANALYTICAL SERVICE
KINGSTON, TN
(615) 482-6497

WESTON



Kandi Brown
IT Corporation
May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

IT ANALYTICAL SERVICES
KINGSTON, TN
(615) 482-6497

PARTICLE SIZE ANALYSIS
ASTM D 422

Project Name: WESTON
Client Number: WAS4/2/93

Project Number: 483500.068.01
ETDC Number: ETDC- 3365

Specific Gravity =	2.6500 Assumed

Moisture Content =	158.8%

SIEVE ANALYSIS

	Sieve No.	Diameter mm	Percent Finer
COARSE	3"	75.000	100.0%
	1.5"	37.500	100.0%
	0.75"	19.000	100.0%
	0.375"	9.500	100.0%
	#4	4.750	100.0%
	#10	2.000	100.0%

	Sieve No.	Diameter mm	Percent Finer
FINE	#20	0.850	100.0%
	#40	0.425	94.5%
	#60	0.250	84.3%
	#100	0.149	74.9%
	#140	0.106	69.8%
	#200	0.075	65.5%

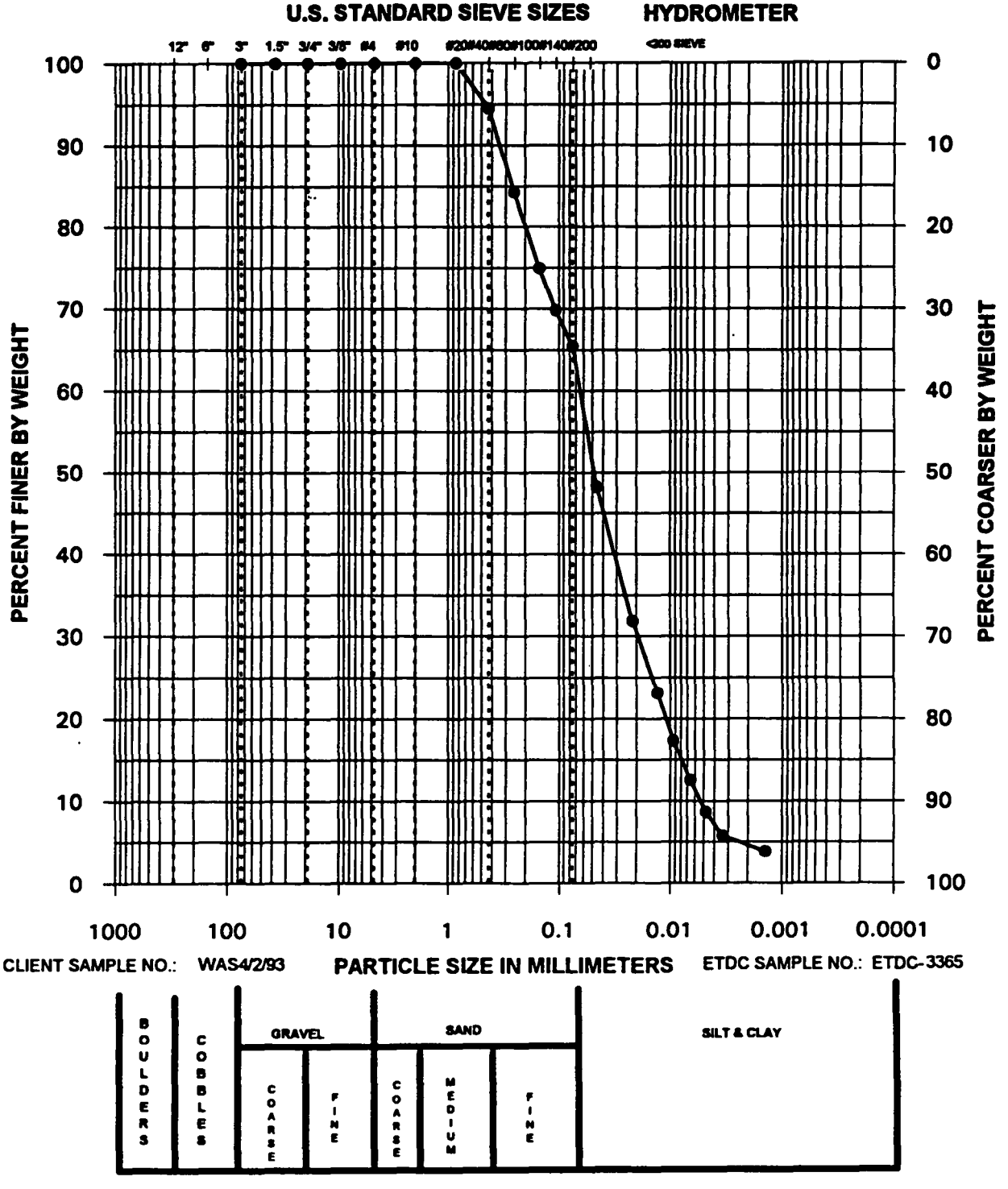
HYDROMETER ANALYSIS

	Diameter mm	Percent Finer
HYDROMETER		
	0.04568	48.2%
	0.02167	31.8%
	0.01285	23.1%
	0.00926	17.3%
	0.00662	12.5%
	0.00476	8.7%
	0.00339	5.8%
	0.00141	3.9%

Kandi Brown
IT Corporation
May 10, 1993
Client Project ID: WESTON
ETDC Project No.: 483500.068.01

IT ANALYTICAL SERVICE
KINGSTON, TN
(615) 482-6497

WESTON



Appendix C

TECHNOLOGY CORPORATION

CHAIN OF CUSTODY RECORD*

Page 1 of ____

Project Name/No. [1] Weston/580000.045 | Samples Shipment Date [7] 1-2-93 | Bill to: [5] 580000.045

Sample Team Members [2] J. Rightmyer/T. Schalk | Lab Destination [8] IT-ETDC

Profit Center No. [3] L3978 | Lab Contact [9] Beverly Leamon

Project Manager [4] Kandi Brown | Project Contact/Phone [12] Kandi Brown/216616 | Report to: [10] Kandi Brown, 312 Directors Drive, Knoxville, TN 37931

Purchase Order No. [6] | Carrier/Waybill No. [13]

Required Report Date [11]

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Preservative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
WAS 1/29/93	WAS Week of 1/25 - 1/29 (SD.I Slurry)	1/29/93	Glass	~1L	NONE	Particle size Analysis ASTM Method D422	FOR LAB USE ONLY	
	ETDC 3226							
							FOR LAB USE ONLY	

Special Instructions: [23]

Possible Hazard Identification: [24] PAH(s)
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☒ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required: [26]
Normal ☒ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify): _____

1. Relinquished by [28] (Signature/Affiliation) Janet Rightmyer IT Corp. Date: 1/29/93 Time: 3:00 pm	1. Received by [28] (Signature/Affiliation) C Brena Date: 2-1-93 Time: 09:30
2. Relinquished by (Signature/Affiliation) Date: Time:	2. Received by (Signature/Affiliation) Date: Time:
3. Relinquished by (Signature/Affiliation) Date: Time:	3. Received by (Signature/Affiliation) Date: Time:

Comments: [29]

MCA 3/15/91

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311486
Page 1 of ____

Project Name/No. [1] WESTON/580000.045
Sample Team Members [2] J. RICHTMYER/T. SCHULZ
Profit Center No. [3] 3978
Project Manager [4] KANDI BROWN
Purchase Order No. [6]
Required Report Date [11]

Samples Shipment Date [7] 2/4/93
Lab Destination [8] IT-ETDC
Lab Contact [9] BEVERLY LEAMON
Project Contact/Phone [12] K. BROWN 690-3211
Carrier/Waybill No. [13]

Bill to: [5] 580000.045
Report to: [10]

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Preservative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
WAS 2/4/93	SOIL SLURRY	2/4/93 1400	GLASS JAR	~1L	NONE	PARTICLE SIZE ANALYSIS ASTM METHOD D422		

ETDC 3227

FOR LAB USE ONLY

Special Instructions: [23]

Possible Hazard Identification: [24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☑ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required: [26]
Normal ☑ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify): _____

1. Relinquished by [28] (Signature/Affiliation) Timothy S. Schulz	Date: 2/4/93 Time: 1510
2. Relinquished by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:

1. Received by [28] (Signature/Affiliation) C. Dauer	Date: 2-5-93 Time: 09:30
2. Received by (Signature/Affiliation)	Date: Time:
3. Received by (Signature/Affiliation)	Date: Time

Comments: [29]

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

TECHNOLOGY CORPORATION

CHAIN OF CUSTODY RECORD*

Project Name/No. [1] WESTON/580000.045
Sample Team Members [2] J. RAHTMEER/T. SCHAUB
Profit Center No. [3] L3978
Project Manager [4] KANDI BROWN
Purchase Order No. [6]
Required Report Date [11]

Samples Shipment Date [7] 02/12/93
Lab Destination [8] IT-ETDC
Lab Contact [9] BEVERLY LEAMON
Project Contact/Phone [12] K. BROWN 690-3211
Carrier/Waybill No. [13]

Bill to: [5] 580000.045
Report to: [10]

Write: To accompany samples Yellow: Field copy

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Preservative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
WAS 2/11/93	SOIL SLURRY	2/11/93 1400	GLASS JAR	NIL	NONE	PARTICLE SIZE ANALYSIS ASTM METHOD D422	ETDC 3286	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

Special Instructions: [23]

Possible Hazard Identification: [24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☑ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required: [26]
Normal ☑ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify): _____

1. Relinquished by [28] (Signature/Affiliation) Timothy S. Schaub	Date: 2/12/93 Time: 1500	1. Received by [28] (Signature/Affiliation) IT ETDC	Date: 2-16-93 Time: @ 1000
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]

*See back of form for special instructions.

MCA 3/15/91

483500.068.01

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311424

Page 1 of ____

Project Name/No.[1] Weston

Sample Team Members[2] T. Schalk, J. Rightmyer

Profit Center No.[3] L3978

Project Manager[4] K. Brown

Purchase Order No.[6]

Required Report Date[11]

Samples Shipment Date[7] 2-18-93

Lab Destination[8] ETDC

Lab Contact[9] Beverly Leamon

Project Contact/Phone[12] K. Brown / 2666

Carrier/Waybill No.[13]

Bill to:[5] 580000 045

Report to:[10] Kandi Brown

ONE CONTAINER PER LINE

Sample Number[14]	Sample Description/Type[15]	Date/Time Collected[16]	Container Type[17]	Sample Volume[18]	Preservative[19]	Requested Testing Program[20]	Condition on[21]	Disposal Record No.[22]
WAS2/18/93	WAS Slurry	2/18/93 2:30p	Glass	1L	—	Particle size analysis ASTM Method D422	ETDC 3326	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

Special Instructions:[23]

Possible Hazard Identification:[24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal:[25]
Return to Client ☒ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required:[26]
Normal ☒ Rush ☐

QC Level:[27]
I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by[28] (Signature/Affiliation) J. Rightmyer / IT-BAC Date: 2/18/93 Time: 2:45pm	1. Received by[28] (Signature/Affiliation) C. Brown / ETDC Date: 2-19-93 Time: 9:30
2. Relinquished by (Signature/Affiliation) Date: Time:	2. Received by (Signature/Affiliation) Date: Time:
3. Relinquished by (Signature/Affiliation) Date: Time:	3. Received by (Signature/Affiliation) Date: Time:

Comments:

White: To accompany samples

Yellow: Field copy

*See back of form for special instructions.

483500.068.01

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311425

Page 1 of 1

Project Name/No.[1] Weston

Sample Team Members[2] T. Schall K.J. Rightmyer

Profit Center No.[3] 3978

Project Manager[4] K. Brown

Purchase Order No.[6]

Required Report Date[11]

Samples Shipment Date[7] 2/25/93

Lab Destination[8] ETDS

Lab Contact[9] Beverly Leamon

Project Contact/Phone[12] K. Brown/2666

Carrier/Waybill No.[13]

Bill to:[5] 580000.045

Report to:[10] K. Brown
312 Directors Drive
Knoxville, TN 37923

White: To accompany samples Yellow: Field copy

ONE CONTAINER PER LINE

Sample Number[14]	Sample Description/Type[15]	Date/Time Collected[16]	Container Type[17]	Sample Volume[18]	Preservative[19]	Requested Testing Program[20]	Condition on[21]	Disposal Record No.[22]
WAS 2/25/93	week solid slurry	2/25/93 9:30a	glass	1L	—	Particle size Analysis ASTM Method D422	ETDC 3327	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

Special Instructions:[23]

Possible Hazard Identification:[24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal:[25]
Return to Client ☐ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required:[26]
Normal ☐ Rush ☐

QC Level:[27]
I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by[28] (Signature/Affiliation) [signature] Date: 2/25/93 Time: 9:30a	1. Received by[28] (Signature/Affiliation) [signature] Date: 2-26-93 Time: 1130
2. Relinquished by (Signature/Affiliation) Date: Time:	2. Received by (Signature/Affiliation) Date: Time:
3. Relinquished by (Signature/Affiliation) Date: Time:	3. Received by (Signature/Affiliation) Date: Time:

Comments:[29]

*See back of form for special instructions.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 31149
Page 1 of ____

Project Name/No. 1 WESTON/580000.045
Sample Team Members 2 J. RAMIREZ / T. SCHALL
Profit Center No. 3 13978
Project Manager 4 KANDI BERRY
Purchase Order No. 6
Required Report Date 11

Samples Shipment Date 7 3/4/93
Lab Destination 8 ETDC
Lab Contact 9 BEVERLY LEAMON
Project Contact/Phone 12 K. BERRY / EXT. 21666
Carrier/Waybill No. 13

Bill to: 5 580000.045
Report to: 10 K. BERRY

ONE CONTAINER PER LINE

Sample Number 14	Sample Description/Type 15	Date/Time Collected 16	Container Type 17	Sample Volume 18	Preservative 19	Requested Testing Program 20	Condition on Receipt 21	Disposal Record No. 22
WAS 3/4/93	WAS SLURRY	3/4/93 1015	GLASS	1L	NONE	PARTICLE SIZE ANALYSIS ASTM METHOD D422	ETDC 3328	

FOR LAB USE ONLY

FOR LAB USE ONLY

Special Instructions: 23

Possible Hazard Identification: 24
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: 25
Return to Client ☑ Disposal by Lab ☐ Archive ____ (mos.

Turnaround Time Required: 26
Normal ☑ Rush ☐

QC Level: 27
I ☐ II ☐ III ☐ Project Specific (specify)

1. Relinquished by 28 (Signature/Affiliation) Timothy S. Schall Date: 3/4/93 Time: 10:30	1. Received by 28 (Signature/Affiliation) James Bolz IT/ETDC Date: 3/5/93 Time: 1021
2. Relinquished by (Signature/Affiliation) Date: Time:	2. Received by (Signature/Affiliation) Date: Time:
3. Relinquished by (Signature/Affiliation) Date: Time:	3. Received by (Signature/Affiliation) Date:

Comments: 29

483500.068.01

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311494

Page 1 of ____

Project Name/No. [1] Weston/580000.045

Sample Team Members [2] T. Schalk

Profit Center No. [3] 3978

Project Manager [4] Kandi Brown

Purchase Order No. [6]

Required Report Date [11]

Samples Shipment Date [7] 3/11/93

Lab Destination [8] ETDC

Lab Contact [9] Beverly Leamon

Project Contact/Phone [12] Kandi Brown/2666

Carrier/Waybill No. [13]

Bill to: [5] 580000.045

Report to: [10]

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Preservative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
WAS 3/11/93	Rx Slurry	3/11/93	glass	1 L		ASTM Method D422 Particle Size Analysis	ETDC 3330	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

Special Instructions: [23]

Possible Hazard Identification: [24]
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☐ Archive ____ (mos.)

Turnaround Time Required: [26]
Normal ☐ Rush ☐

QC Level: [27]
I ☐ II ☐ III ☐

Project Specific (specify)

1. Relinquished by [28] (Signature/Affiliation)	Date: Time:	1. Received by [28] (Signature/Affiliation)	Date: 3-12-93 Time: 1310
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]

White: To accompany samples Yellow: Field copy

*See back of form for special instructions.

483500.0002

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311427
Page 1 of ____

Project Name/No. [1] Neston/408491
Sample Team Members [2] J. Rightmyer, T. Smith
Profit Center No. [3] 3978
Project Manager [4] Kandi Brown
Purchase Order No. [6]
Required Report Date [11]

Samples Shipment Date [7] 3/18/93
Lab Destination [8] IT-ETDC
Lab Contact [9] Beverly Leamon
Project Contact/Phone [12] Kandi Brown/2666
Carrier/Waybill No. [13]

Bill to: [5] 580000.045

Report to: [10] Kandi Brown
312 Directors Drive
Knoxville, TN 37923

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Preservative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]
WAS 3/18	RX slurry	2:15pm 3/18/93	glass	1 L	—	ASTM Method D422 Particle Size Analysis	ETDC 3337	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

Special Instructions: [23]

Possible Hazard Identification: [24] PAH(s)
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☒ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required: [26]
Normal ☒ Rush ☐

QC Level: [27]
I. ☐ II. ☐ III. ☐ Project Specific (specify): _____

1. Relinquished by [28] (Signature/Affiliation) Janet Rightmyer, ITBAC — Date: 3/18/93 Time: 2:20pm	1. Received by [28] (Signature/Affiliation) [signature] IT/ETDC — Date: 3-19-93 Time: 1110
2. Relinquished by (Signature/Affiliation) — Date: Time:	2. Received by (Signature/Affiliation) — Date: Time:
3. Relinquished by (Signature/Affiliation) — Date: Time:	3. Received by (Signature/Affiliation) — Date: Time:

[29]

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 311400

Page 1 of ____

Project Name/No.[1] Weston 40849/1 | Samples Shipment Date[7] 3/25/93 | Bill to:[5] 580000.045

Sample Team Members[2] T. Rightmyer, T. Smith | Lab Destination[8] IT - ETDC

Profit Center No.[3] 3978 | Lab Contact[9] Beverly Lemmon

Project Manager[4] Kandi Brown | Project Contact/Phone[12] Kandi Brown ext. 4666 | Report to:[10] Kandi Brown

Purchase Order No.[6] | Carrier/Waybill No.[13] | 319 Director DR

Required Report Date[11] | | Knox, TN 37683

ONE CONTAINER PER LINE

Sample Number[14]	Sample Description/Type[15]	Date/Time Collected[16]	Container Type[17]	Sample Volume[18]	Preservative[19]	Requested Testing Program[20]	Condition on Receipt[21]	Disposal Record No.[22]
WAS 3/18/93 35 & 3/30	RI SLURRY	3/25/93 10:00AM	GLASS	1L	-	ASTM Method D422 Particle Size Analysis	ETDC 3352 6K	

FOR LAB USE ONLY

FOR LAB USE ONLY

Special Instructions:[23]

Possible Hazard Identification:[24] PAH(s)
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal:[25]
Return to Client ☐ Disposal by Lab ☐ Archive _____ (mos.)

Turnaround Time Required:[26]
Normal ☐ Rush ☐

QC Level:[27]
I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by[28] (Signature/Affiliation) Tony R. Smith — Date: 3/25/93 Time: 10:00 am	1. Received by[28] (Signature/Affiliation) Joel K. Shaw ETDC — Date: 3-26-93 Time: 1355
2. Relinquished by (Signature/Affiliation) — Date: Time:	2. Received by (Signature/Affiliation) — Date: Time:
3. Relinquished by (Signature/Affiliation) — Date: Time:	3. Received by (Signature/Affiliation) — Date: Time:

Comments:[29]

White: To accompany samples Yellow: Field copy *See back of form for special instructions.

MCA 3/15/91

4 83500.068.01

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No.

Page 1 of ___

Project Name/No.[1] Weston/580000.045 Samples Shipment Date[7] 4/2/93 Bill to:[5] 580000.045

Sample Team Members[2] J. Rightmyer Lab Destination[8] IT-ETDC

Profit Center No.[3] 3978 Lab Contact[9] Beverly Leamon

Project Manager[4] Kandi Brown Project Contact/Phone[12] Kandi Brown 26666 Report to:[10] Kandi Brown

Purchase Order No.[6] Carrier/Waybill No.[13]

Required Report Date[11]

ONE CONTAINER PER LINE

Sample Number[14]	Sample Description/Type[15]	Date/Time Collected[16]	Container Type[17]	Sample Volume[18]	Preservative[19]	Requested Testing Program[20]	Condition on Receipt[21]	Disposal Record No.[22]
WAS 4/2/93	Rx Slurry 4/2/93	4/2/93 1130	glass	1L	NA	Particle Size Analysis ASTM Method D422	ETDC 3365	
							FOR LAB USE ONLY	
							FOR LAB USE ONLY	

Special Instructions:[23]

Possible Hazard Identification:[24] Creosote-Cont. (PAHs)
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal:[25] Return to Client ☐ Disposal by Lab ☐ Archive ___ (mos.)

Turnaround Time Required:[26] Normal ☐ Rush ☐

QC Level:[27] I. ☐ II. ☐ III. ☐ Project Specific (specify):

1. Relinquished by[28] (Signature/Affiliation) Janet Rightmyer	Date: 4/2/93 Time: 11:45am	1. Received by[28] (Signature/Affiliation)	Date: 4-5-93 Time: 1320
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments:[29]

White: To accompany samples

Yellow: Field copy

*See back of form for special instructions.

BAC PAH Data Package

BAC DATA PACKAGE

A. Initial Calibrations

The HPLC was recalibrated with each batch of samples. A three-point calibration was performed automatically based on data generated from serial dilutions of a certified standard (Supelco 610-PAH Mix). With each recalibration, a calibration summary was printed depicting the linear regression, linear equation, and correlation coefficient for each of the 16 PAH analytes.

Analyte concentrations within a sample were interpolated automatically based upon the above linear regressions and subsequent dilution factors. A representative series of calibration standards, a calibration summary, results of a sample analysis, and results of a method blank analysis are included. The coefficient of variation was 0.99. These examples are from actual analyses performed on 4/16/93.

B. HPLC Run Log

The HPLC run log for the project is included.

DIONEX METHOD PARAMETERS - RX412.MET

Method Comment: RX412.MET
Column ID: Perkin Elmer PAH C18
Analyst ID: J. Rightmyer

System Parameters

System Name: pah/anions

Number of Detectors	1
Run Time (minutes)	30.00
Sampling Rate (seconds)	0.20
Detector 1 Type	VDM-2
Detector 1 real time plot scale maximum (AU)	0.100
minimum	-0.010
Save Data File	Yes

Data File Name: C:\DX\DATA\RX412001.D04

-- DETECTOR 1 PARAMETERS --

Report Options

Create ASCII Report File	No
Print Report	Yes
Print All Components	Yes
Print Components Found	No
Print Missing Components	No
Print All Peaks	Yes
Print Unknown Peaks	Yes
Print Chromatogram	Yes
Autoscale Chromatogram Maximum	No
Autoscale Chromatogram Minimum	No
Fill Peaks with Color	Yes
Draw Grid Lines on Chromatogram	No
Show Component Fraction Numbers	No
Label with Peak Number	Yes
Label with Retention Times on Chromatogram	No
Label with Component Name	No

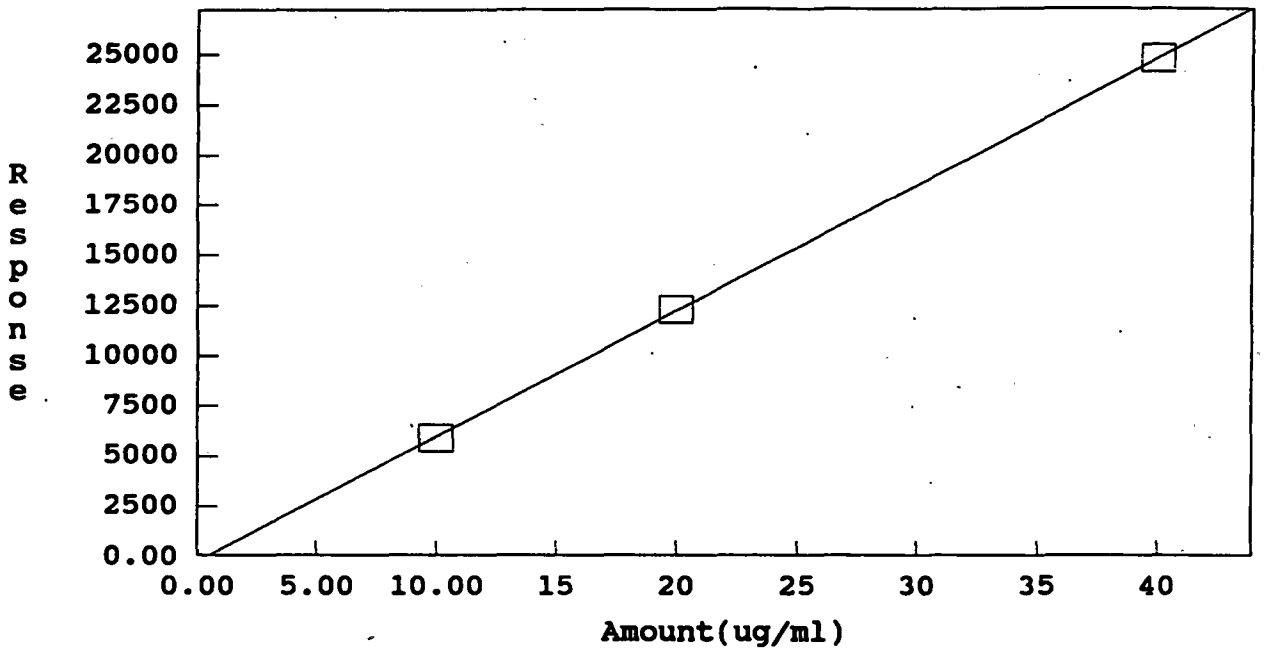
Format File Name: C:\DX\METHOD\default.prf

Integration Parameters

Starting Peak Width (seconds)	10.0
Peak Threshold	1.200
Peak Area Reject	50
Area Reject for Reference Peaks	5

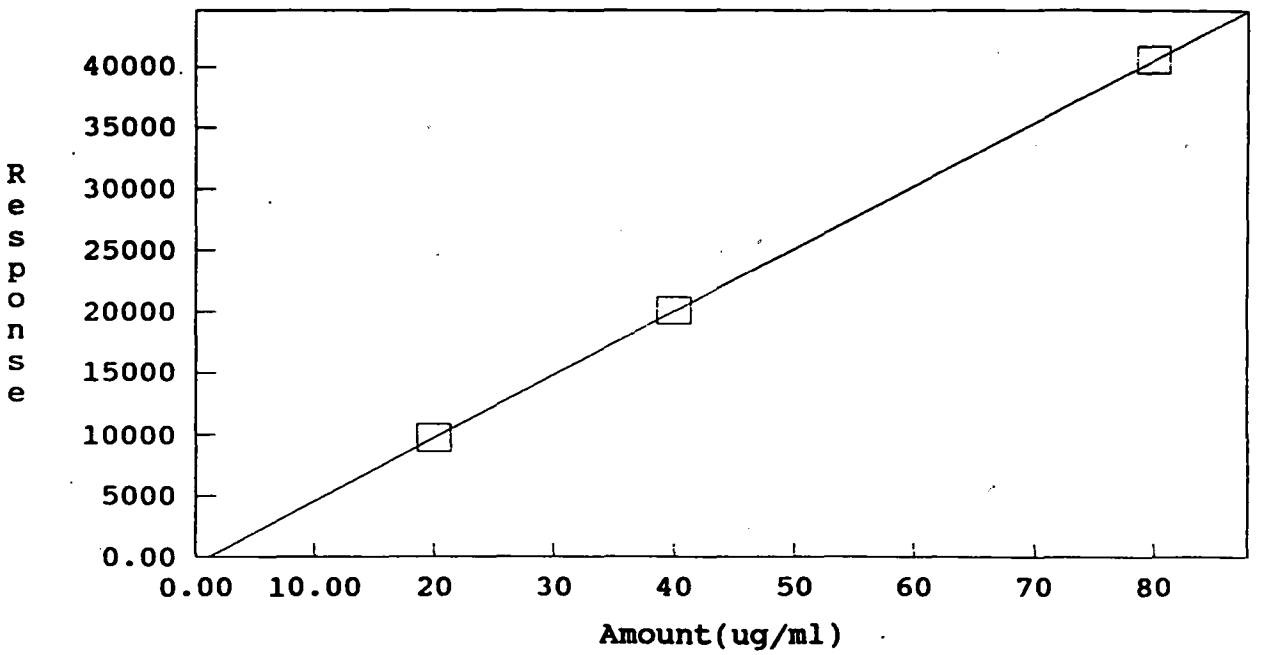
-Method Updated: 14:55 on Fri, 16 Apr 1993

Component: Naphthalene
Fit Type: Linear
r^2 = 0.999956
Amt = Resp * 0.001596 + 0.5225
Resp = Amt * 626.7 + -327.4
Standardization: External
Calibration: Area



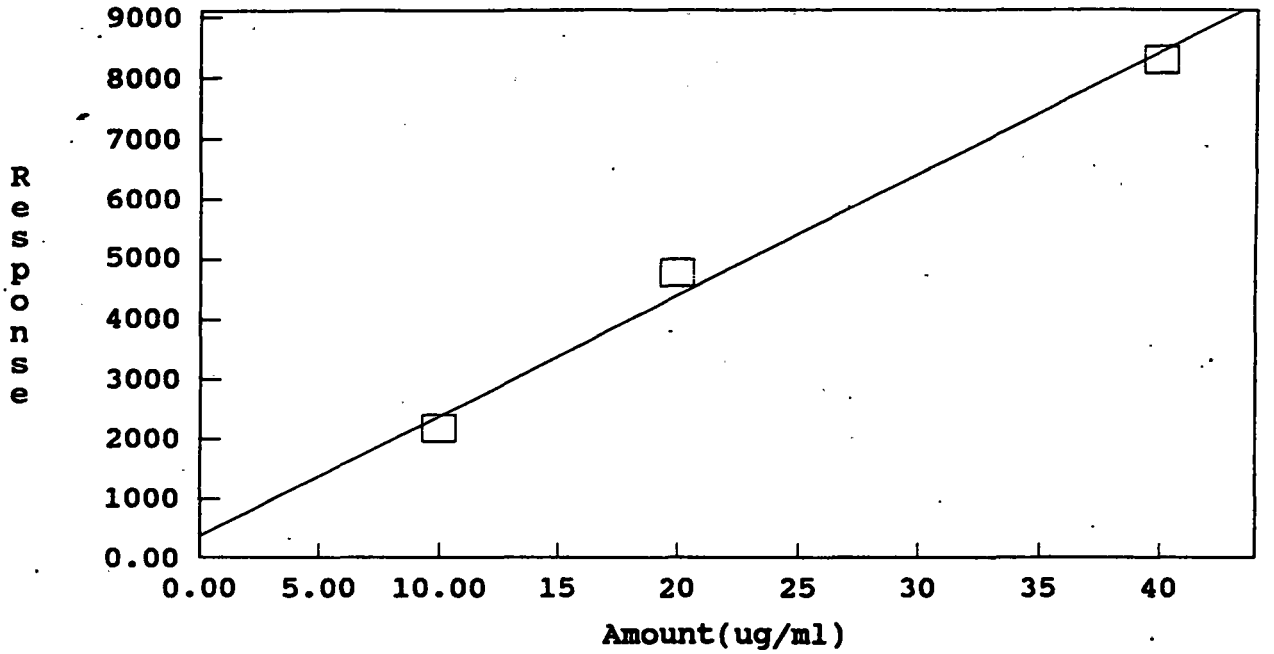
Method: C:\DX\METHOD\RX412.MET

Component: Acenaphthylene
Fit Type: Linear
r^2 = 0.999996
Amt = Resp * 0.001947 + 1.087
Resp = Amt * 513.5 + -558.3
Standardization: External
Calibration: Area



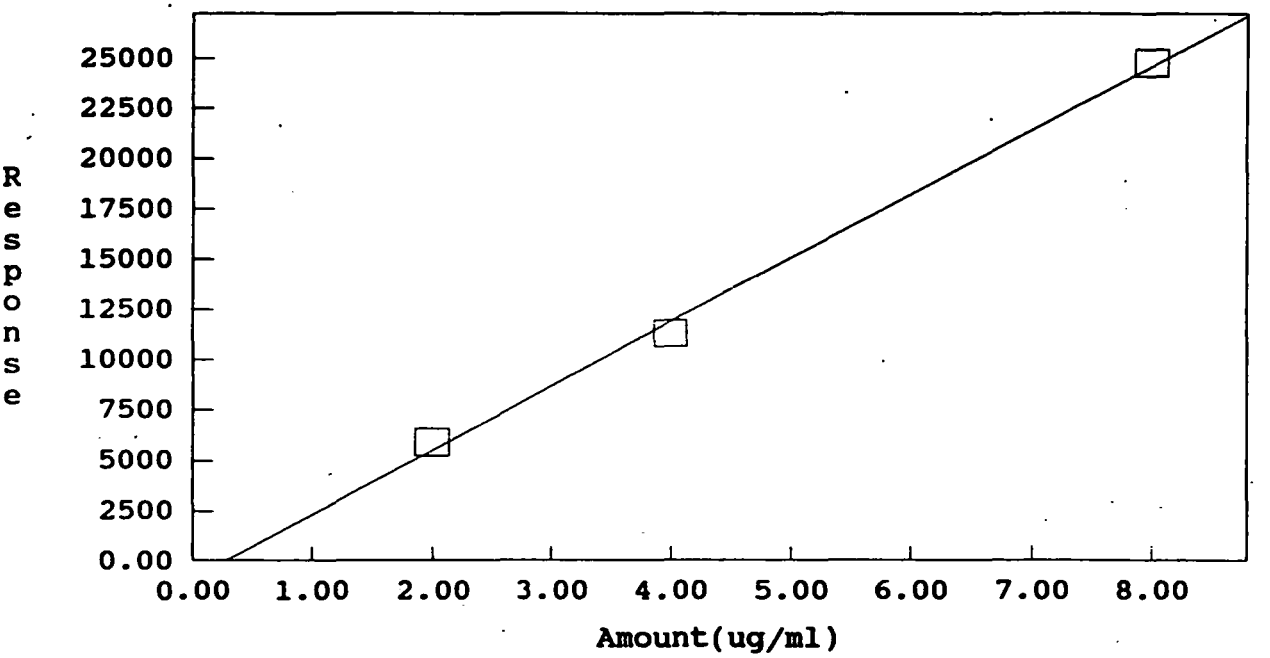
Method: C:\DX\METHOD\RX412.MET

Component: Acenaphthene
Fit Type: Linear
r^2 = 0.989422
Amt = Resp * 0.004962 + -1.851
Resp = Amt * 201.5 + 373
Standardization: External
Calibration: Area



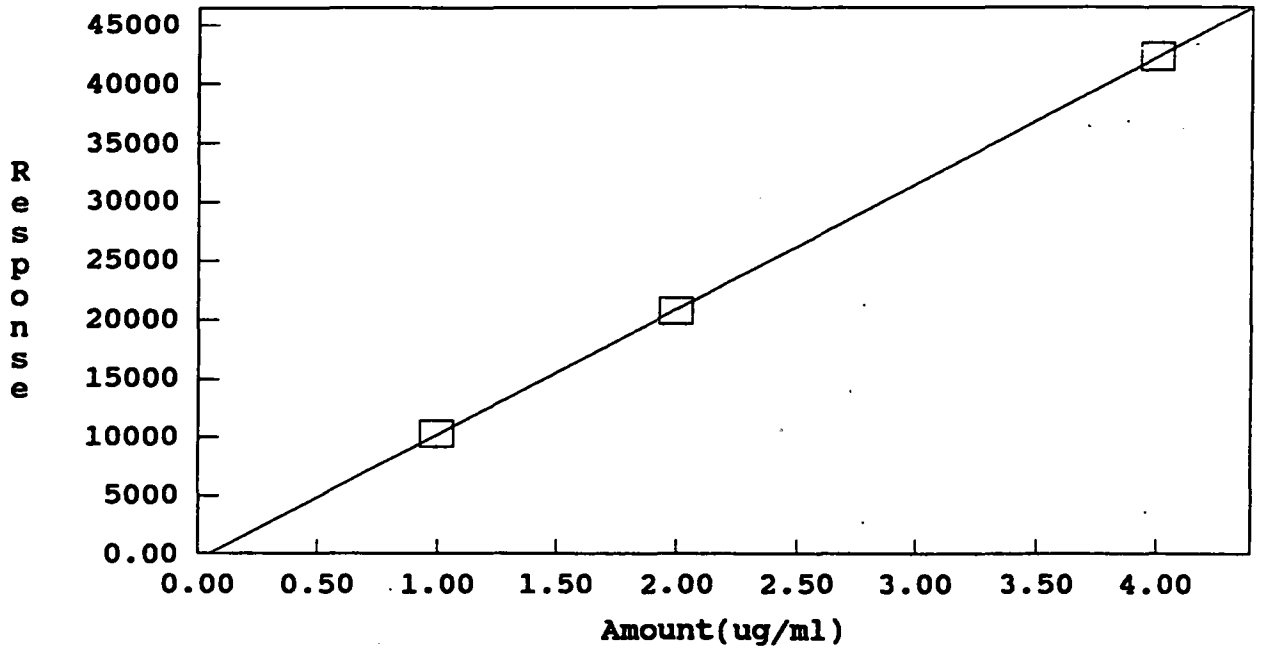
Method: C:\DX\METHOD\RX412.MET

Component: Fluorene
Fit Type: Linear
r^2 = 0.997092
Amt = Resp * 0.0003143 + 0.2789
Resp = Amt * 3182 + -887.4
Standardization: External
Calibration: Area



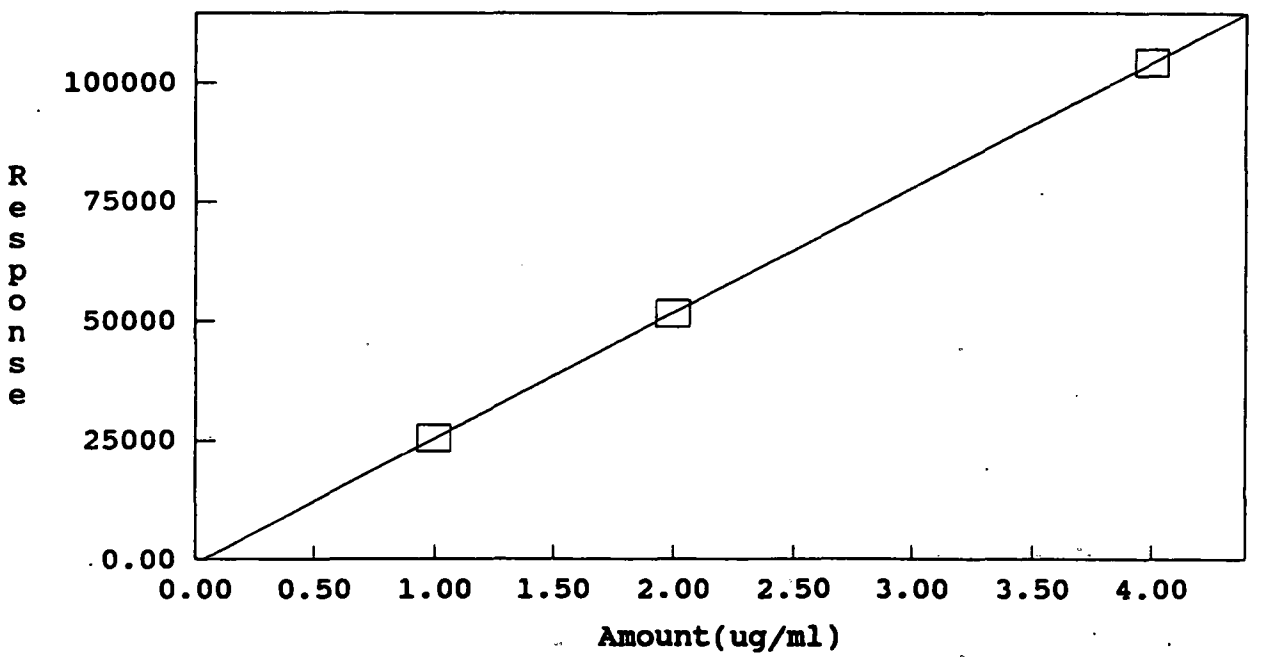
Method: C:\DX\METHOD\RX412.MET

Component: Phenanthrene
Fit Type: Linear
r^2 = 0.999948
Amt = Resp * 9.374e-005 + 0.045
Resp = Amt * 1.067e+004 + -482.
Standardization: External
Calibration: Area



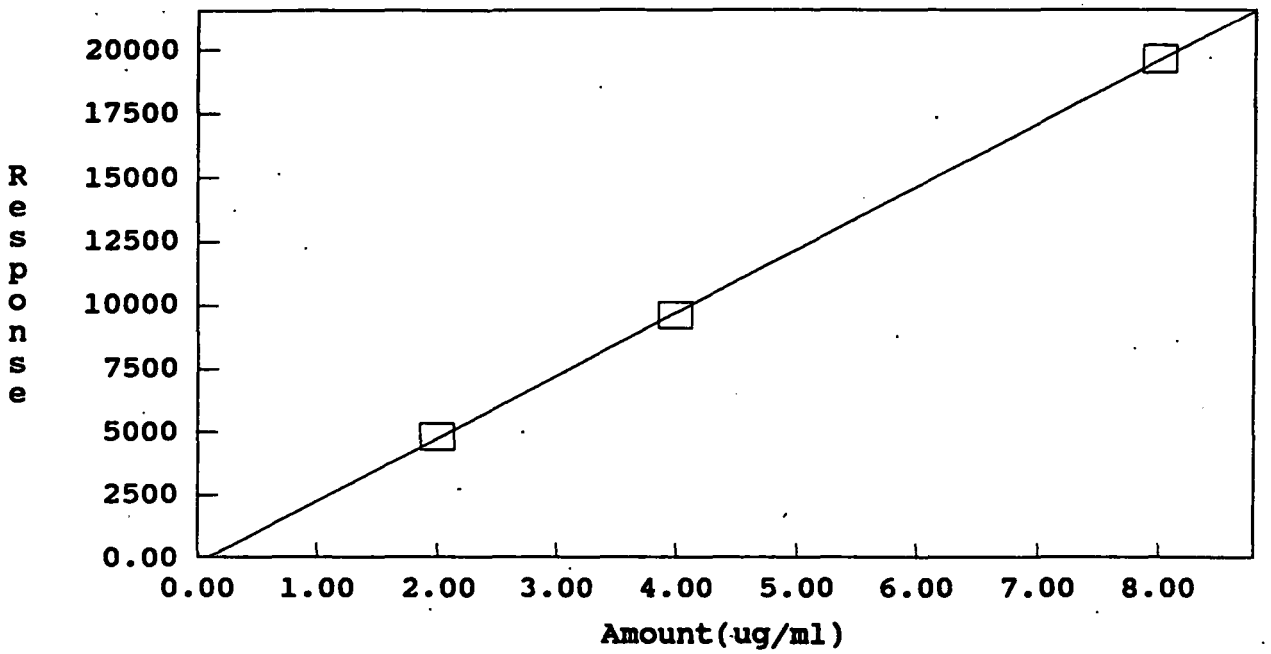
Method: C:\DX\METHOD\RX412.MET

Component: Anthracene
Fit Type: Linear
r^2 = 0.999991
Amt = Resp * 3.809e-005 + 0.03323
Resp = Amt * 2.626e+004 + -872.5
Standardization: External
Calibration: Area



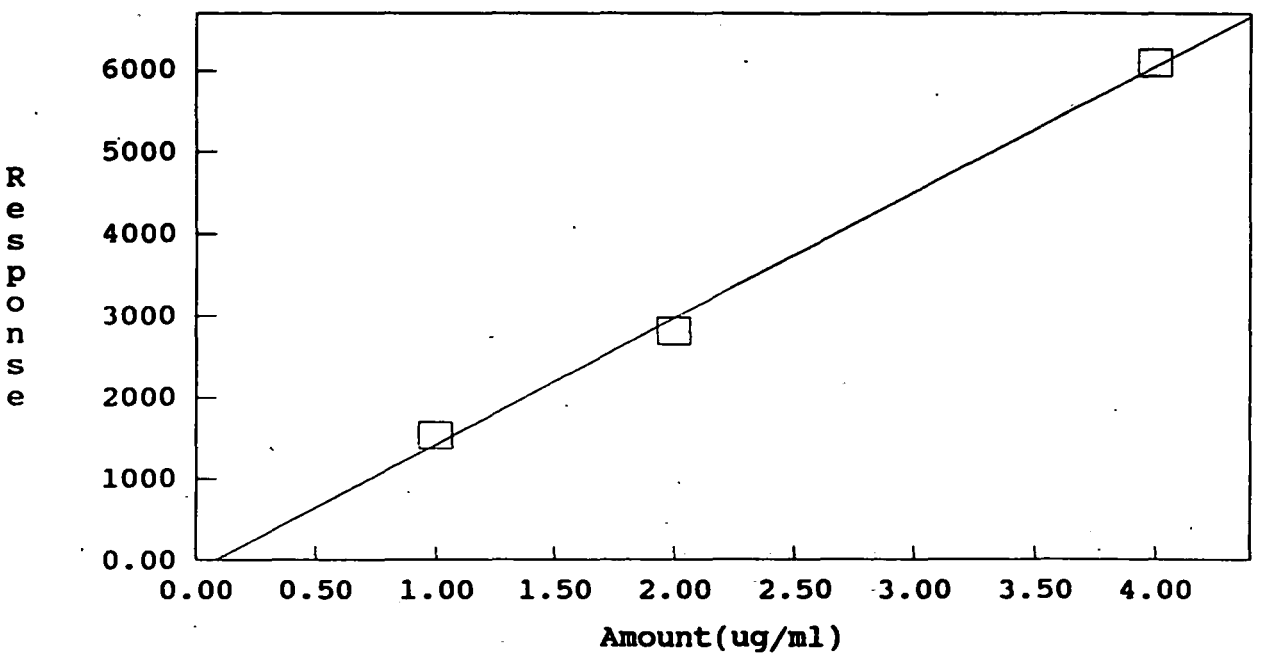
Method: C:\DX\METHOD\RX412.MET

Component: Fluoranthene
Fit Type: Linear
r^2 = 0.999871
Amt = Resp * 0.0004041 + 0.0880
Resp = Amt * 2475 + -217.9
Standardization: External
Calibration: Area



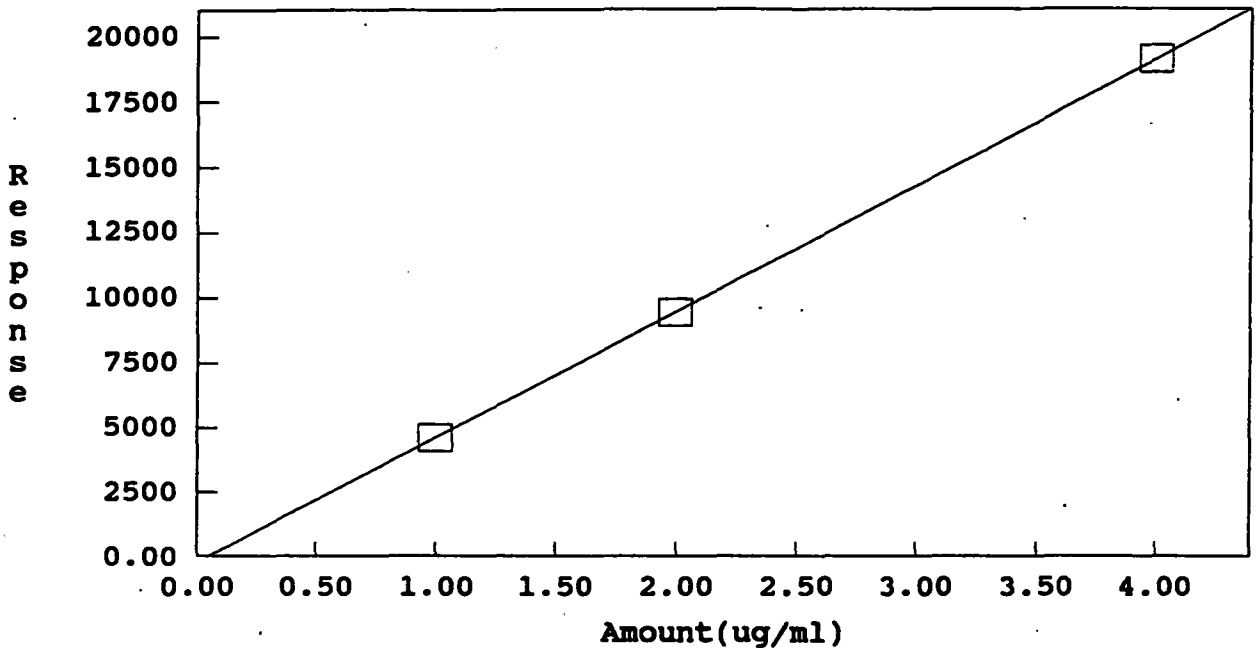
Method: C:\DX\METHOD\RX412.MET

Component: Pyrene
Fit Type: Linear
r^2 = 0.996453
Amt = Resp * 0.0006487 + 0.0819
Resp = Amt * 1542 + -126.4
Standardization: External
Calibration: Area



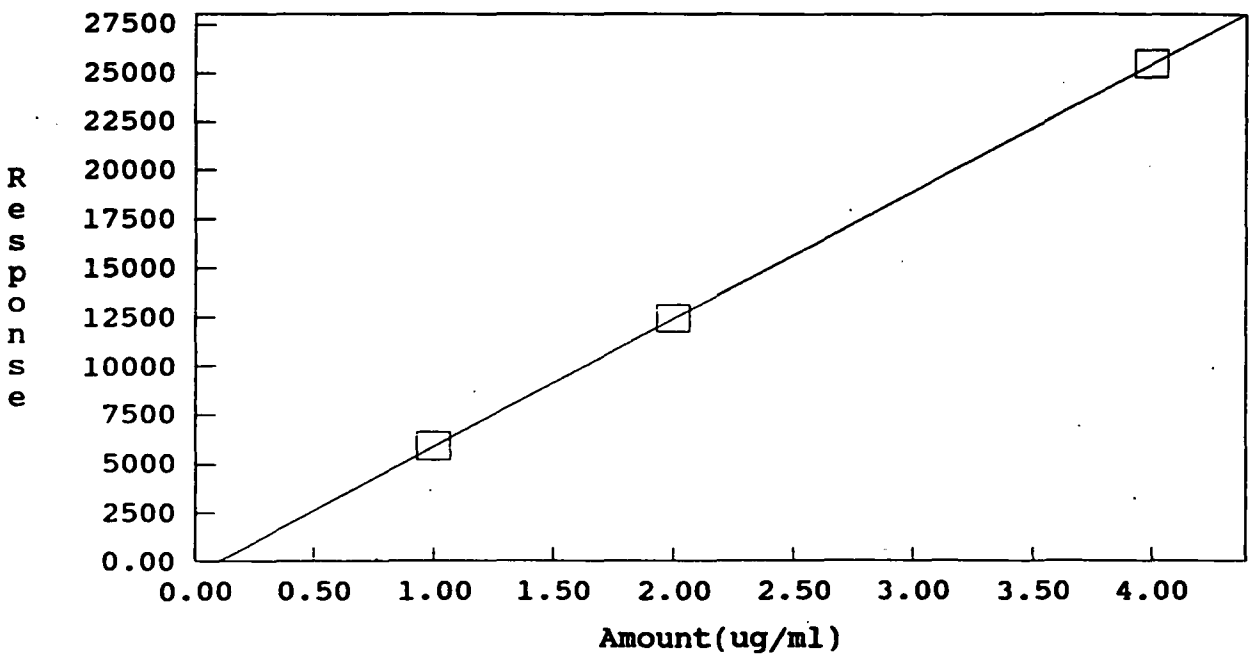
Method: C:\DX\METHOD\RX412.MET

Component: Benzo(a)anthracen
Fit Type: Linear
r^2 = 1.000000
Amt = Resp * 0.0002066 + 0.0507
Resp = Amt * 4840 + -245.7
Standardization: External
Calibration: Area



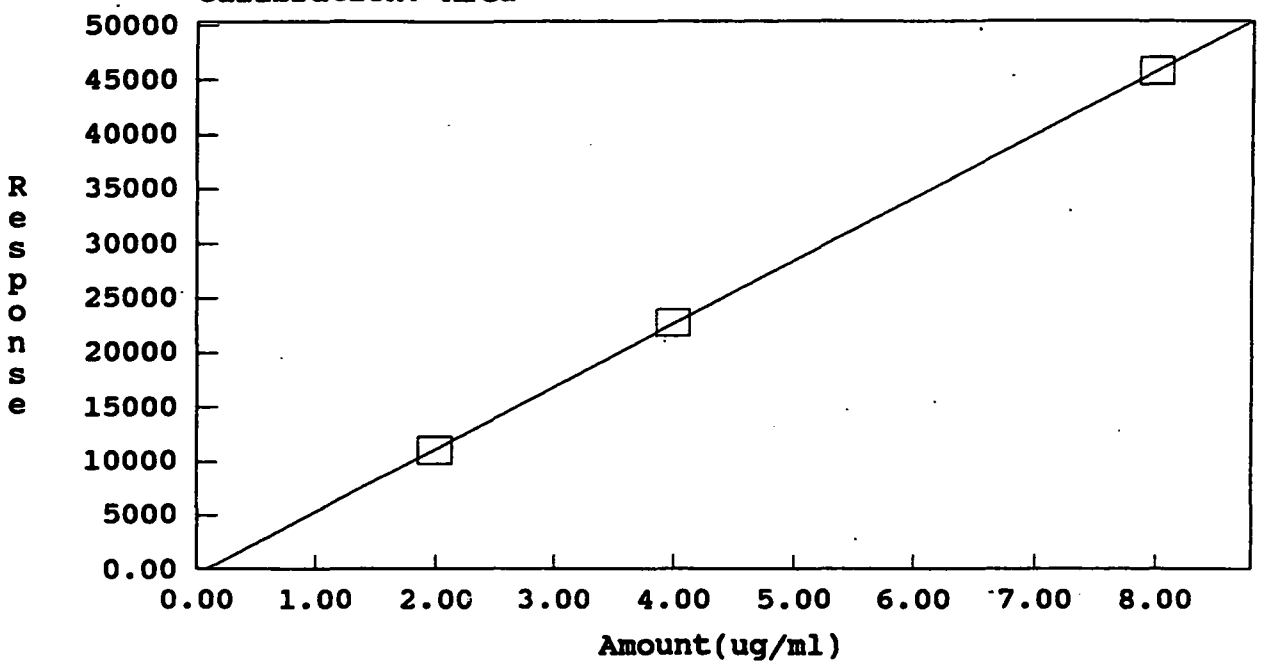
Method: C:\DX\METHOD\RX412.MET

Component: Chrysene
Fit Type: Linear
r^2 = 1.000000
Amt = Resp * 0.0001533 + 0.0968
Resp = Amt * 6524 + -632.1
Standardization: External
Calibration: Area



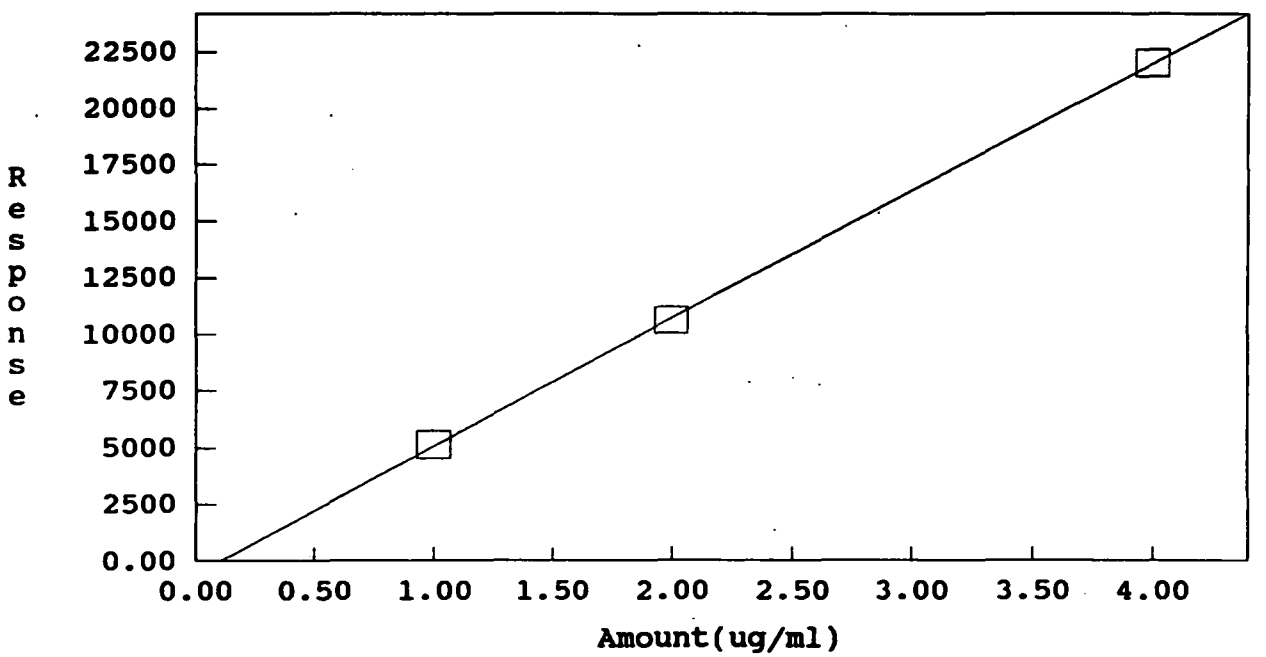
Method: C:\DX\METHOD\RX412.MET

Component: Benzo(b)fluoranth
Fit Type: Linear
r^2 = 0.999961
Amt = Resp * 0.000173 + 0.08262
Resp = Amt * 5779 + -477.4
Standardization: External
Calibration: Area



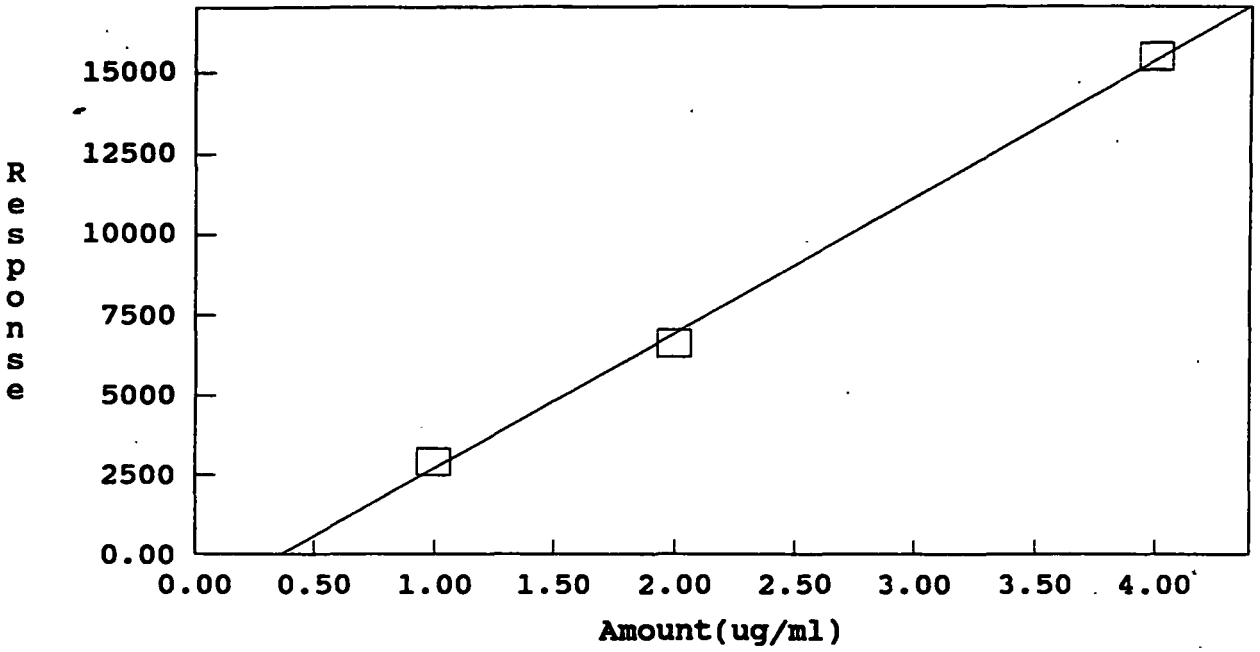
Method: C:\DX\METHOD\RX412.MET

Component: Benzo(k)fluoranth
Fit Type: Linear
r^2 = 0.999921
Amt = Resp * 0.0001774 + 0.1049
Resp = Amt * 5637 + -591.1
Standardization: External
Calibration: Area



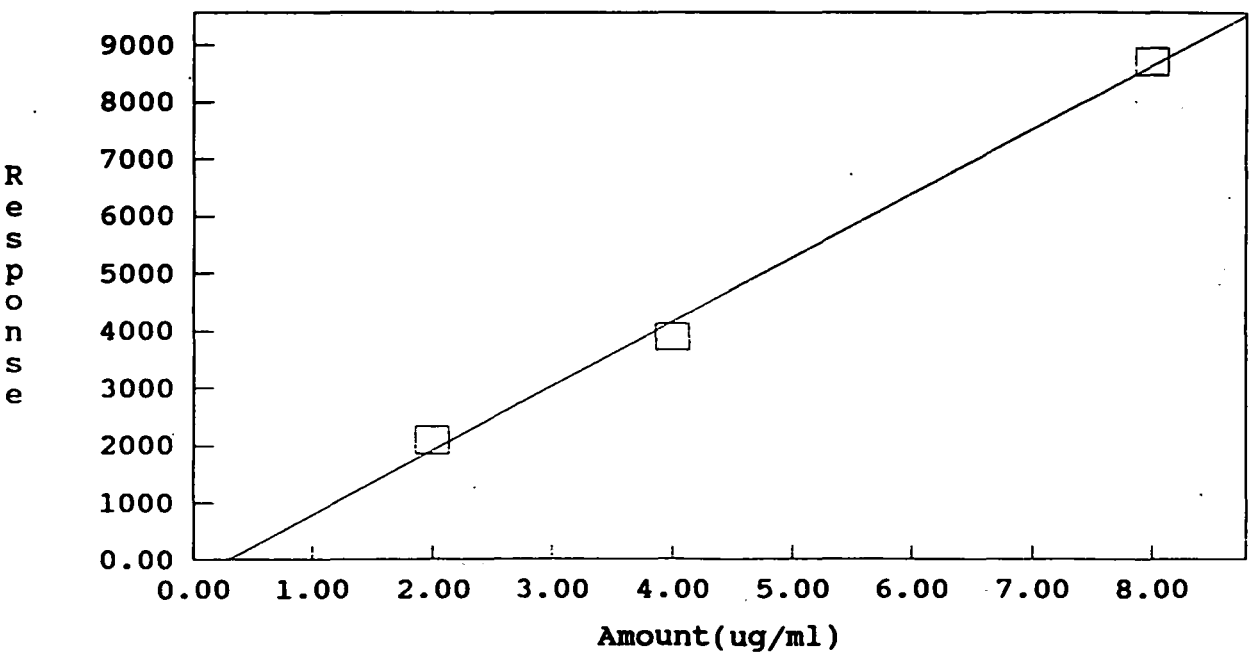
Method: C:\DX\METHOD\RX412.MET

Component: Benzo(a)pyrene
Fit Type: Linear
r^2 = 0.998247
Amt = Resp * 0.0002368 + 0.3606
Resp = Amt * 4222 + -1522
Standardization: External
Calibration: Area



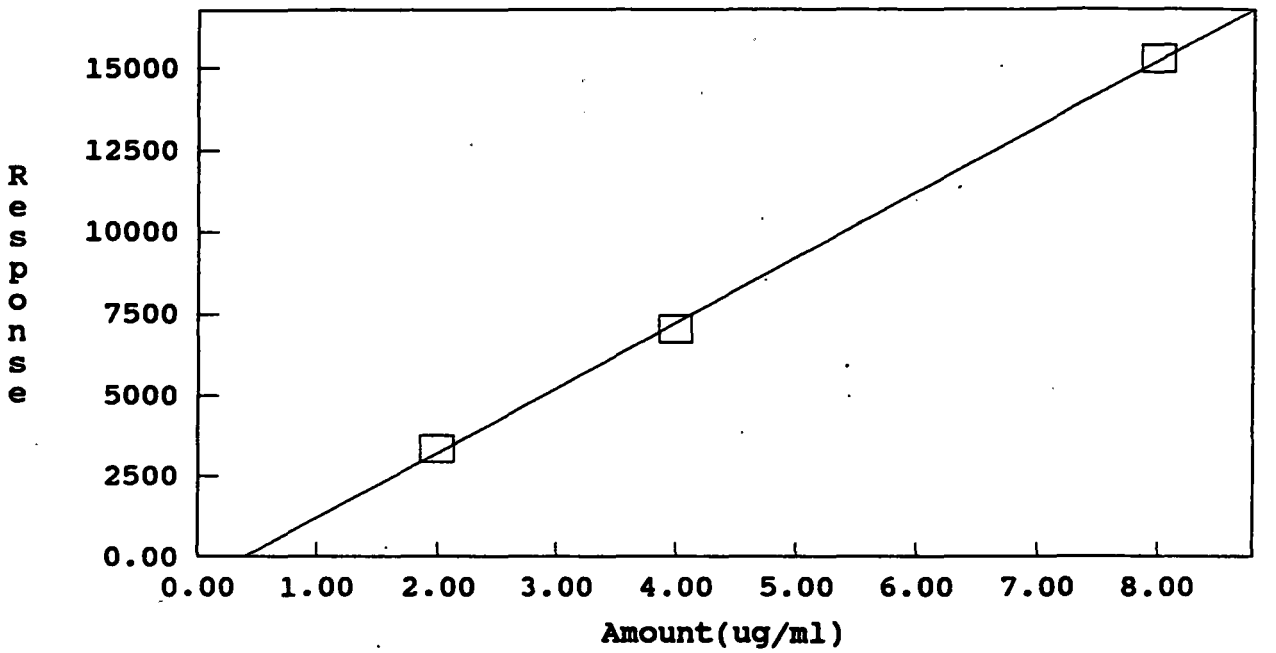
Method: C:\DX\METHOD\RX412.MET

Component: Dibenzo(a,h)anthr
Fit Type: Linear
r^2 = 0.995547
Amt = Resp * 0.000892 + 0.2979
Resp = Amt * 1121 + -334
Standardization: External
Calibration: Area



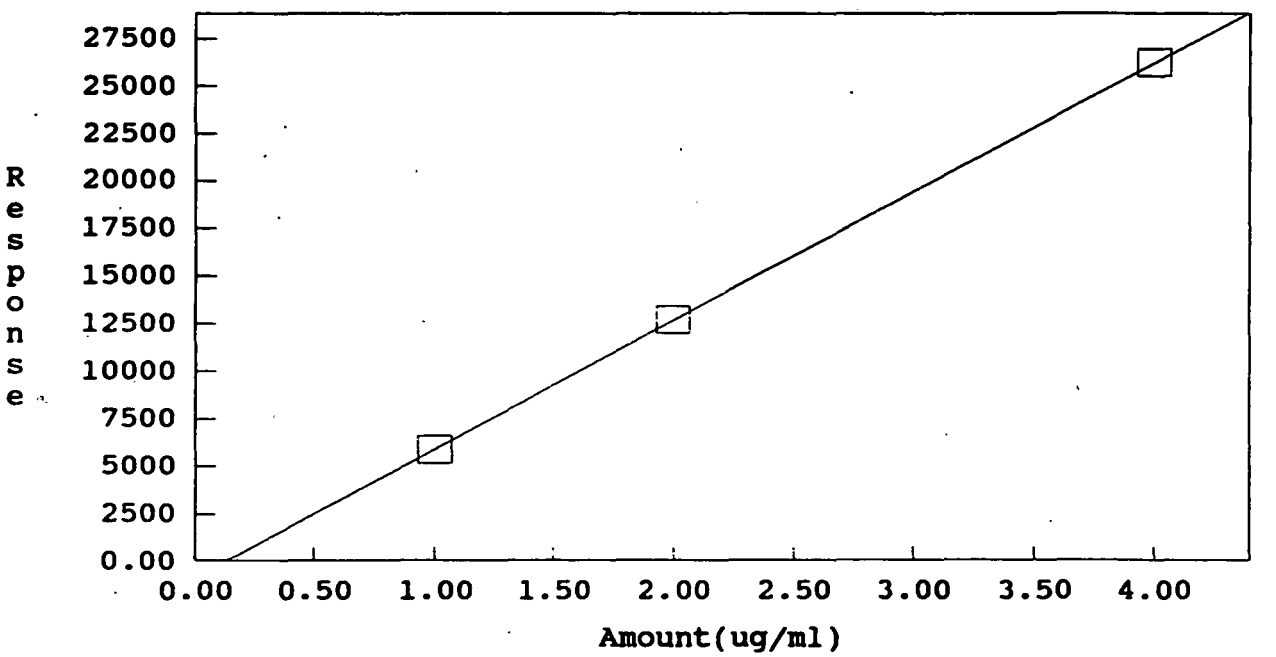
Method: C:\DX\METHOD\RX412.MET

Component: Benzo(g,h,i)peryl
Fit Type: Linear
r^2 = 0.999222
Amt = Resp * 0.0005012 + 0.3923
Resp = Amt * 1995 + -782.6
Standardization: External
Calibration: Area



Method: C:\DX\METHOD\RX412.MET

Component: Indenoperylene
Fit Type: Linear
r^2 = 0.999990
Amt = Resp * 0.0001477 + 0.131
Resp = Amt * 6770 + -886.6
Standardization: External
Calibration: Area



Calibration Parameters

Number Of Levels for Calibration	3
Force Calibration Curve Through Origin	No
Calibration Fit Type	Linear
Replace Or Average Calibrations	Replace
External or Internal Calibration	External
Calculate Unknowns by Area or Height	Area
Default Sample Volume	1.0
Default Dilution Factor	1.0
Default Response Factor for Unknown Peaks	0.0
Calibration Standard Volume	1.0
Internal Standard Amount in Samples	1.0
Amount Units	ug/ml

Component Table -- Last Modified: 09:43 on Sun, 08 Aug 1993

Component # 1 Naphthalene Retention Time 5.52
Reference Comp. Naphthalene Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 5.22539E-001
K1 = 1.59579E-003

Level	Amount	Area	Height
1	4.00000E+001	24714	3183
2	2.00000E+001	12278	1613
3	1.00000E+001	5891	774

Component # 2 Acenaphthylene Retention Time 6.23
Reference Comp. Acenaphthylene Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 1.08718E+000
K1 = 1.94729E-003

Level	Amount	Area	Height
1	8.00000E+001	40512	5071
2	4.00000E+001	20020	2502
3	2.00000E+001	9688	1254

Component # 3 Acenaphthene Retention Time 7.13
Reference Comp. Acenaphthene Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = -1.85069E+000
K1 = 4.96181E-003

Level	Amount	Area	Height
1	4.00000E+001	8280	1132
2	2.00000E+001	4768	586
3	1.00000E+001	2179	291

Component # 4 Fluorene Retention Time 7.32
Reference Comp. Fluorene Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 2.78899E-001
K1 = 3.14300E-004

Level	Amount	Area	Height
1	8.00000E+000	24733	2939
2	4.00000E+000	11252	1510
3	2.00000E+000	5896	722

Component # 5 Phenanthrene Retention Time 7.92
Reference Comp. Phenanthrene Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 4.51995E-002
K1 = 9.37368E-005

Level	Amount	Area	Height
1	4.00000E+000	42234	5101
2	2.00000E+000	20721	2522
3	1.00000E+000	10276	1222

Component # 6 Anthracene Retention Time 8.43
Reference Comp. Anthracene Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 3.32280E-002
K1 = 3.80857E-005

Level	Amount	Area	Height
1	4.00000E+000	104199	12017
2	2.00000E+000	51504	6032
3	1.00000E+000	25476	3031

Component # 7 Fluoranthene Retention Time 9.15
Reference Comp. Fluoranthene Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 8.80454E-002
K1 = 4.04072E-004

Level	Amount	Area	Height
1	8.00000E+000	19612	2224
2	4.00000E+000	9584	1085
3	2.00000E+000	4798	548

Component # 8 Pyrene Retention Time 9.57
Reference Comp. Pyrene Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 8.19638E-002
K1 = 6.48660E-004

Level	Amount	Area	Height
1	4.00000E+000	6084	719
2	2.00000E+000	2800	351
3	1.00000E+000	1528	183

Component # 9 Benzo(a)anthracen Retention Time 11.17
Reference Comp. Benzo(a)anthracen Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 5.07640E-002
K1 = 2.06609E-004

Level	Amount	Area	Height
1	4.00000E+000	19113	2088
2	2.00000E+000	9439	1040
3	1.00000E+000	4591	511

Component # 10 Chrysene Retention Time 11.42
Reference Comp. Chrysene Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 9.68850E-002
K1 = 1.53280E-004

Level	Amount	Area	Height
1	4.00000E+000	25464	2487
2	2.00000E+000	12416	1247
3	1.00000E+000	5892	613

Component # 11 Benzo(b)fluoranth Retention Time 12.83
Reference Comp. Benzo(b)fluoranth Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 8.26201E-002
K1 = 1.73045E-004

Level	Amount	Area	Height
1	8.00000E+000	45711	4459
2	4.00000E+000	22763	2224
3	2.00000E+000	10998	1090

Component # 12 Benzo(k)fluoranth Retention Time 13.40
Reference Comp. Benzo(k)fluoranth Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 1.04862E-001
K1 = 1.77391E-004

Level	Amount	Area	Height
1	4.00000E+000	21986	2140
2	2.00000E+000	10597	1059
3	1.00000E+000	5104	509

Component # 13 Benzo(a)pyrene Retention Time 13.88
Reference Comp. Benzo(a)pyrene Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 3.60564E-001
K1 = 2.36829E-004

Level	Amount	Area	Height
1	4.00000E+000	15457	1483
2	2.00000E+000	6619	654
3	1.00000E+000	2914	299

Component # 14 Dibenzo(a,h)anthr Retention Time 14.91
Reference Comp. Dibenzo(a,h)anthr Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 2.97928E-001
K1 = 8.92016E-004

Level	Amount	Area	Height
1	8.00000E+000	8704	865
2	4.00000E+000	3895	413
3	2.00000E+000	2094	213

Component # 15 Benzo(g,h,i)peryl Retention Time 15.32
Reference Comp. Benzo(g,h,i)peryl Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 3.92286E-001
K1 = 5.01235E-004

Level	Amount	Area	Height
1	8.00000E+000	15237	1460
2	4.00000E+000	7006	681
3	2.00000E+000	3340	334

Component # 16 Indenoperylene Retention Time 15.67
Reference Comp. Indenoperylene Window Size 0.10 min.
Amount = K0 + K1*Area
K0 = 1.30967E-001
K1 = 1.47720E-004

Level	Amount	Area	Height
1	4.00000E+000	26179	2478
2	2.00000E+000	12690	1204
3	1.00000E+000	5858	587

Group Table

Group 1 -

Group 2 -

Group 3 -

Group 4 -

Group 5 -

Group 6 -

Timed Events File: C:\DX\METHOD\PAH.TE

Step	Time	Description
Init		ACI Autosmp OFF
Init		ACI RLY 2 OFF
Init		ACI RLY 3 OFF
Init		ACI RLY 4 OFF
Init		ACI TTL 1 OFF
Init		ACI TTL 2 OFF
Init		ACI TTL 3 OFF
Init		ACI TTL 4 OFF
Init		ACI AC2 OFF
Init		ACI AC 2 OFF
Init		VDM-2 AutoOffset OFF
Init		VDM-2 Recorder Mark OFF
Init		VDM-2 Recorder Range = 0.010 AU
Init		VDM-2 Wavelength = 254 nm
Init		GPM Start
Init		GPM Hold Gradient Clock
Init		GPM Reset OFF
1	0.3	ACI Autosmp ON
1	0.3	Start Sampling
1	0.3	VDM-2 AutoOffset ON
1	0.3	GPM Run Gradient Clock

Lo Pressure Limit = 0
Hi Pressure Limit = 4500
Eluent 1 - ACN
Eluent 2 - DI
Eluent 3 -
Eluent 4 -
V5 Off - pah
V5 On - V6
V6 Off - Off
V6 On - on

Time	Flow	%1	%2	%3	%4	V5	V6	Comment
0.0	1.5	35	65	0	0	0	0	
14.0	1.5	100	0	0	0	0	0	
25.0	1.5	100	0	0	0	0	0	
30.0	1.5	35	65	0	0	0	0	

Data Reprocessed On 07/31/1993 13:24:32

Sample Name: AUTOCAL1 Date: 04/16/1993 11:04:05
Data File : C:\DX\DATA\RX412001.D02
Method : C:\DX\METHOD\rx412.met
ACI Address: 1 System: 1 Inject#: 2 Vial: Detector:VDM-2
Analyst : Column:

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	9000	5Hz	0.00	30.00	50

********** Component Report: All Components **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delta
2	5.52	Naphthalene	40.000	3183	24714	1	-0.06
3	6.23	Acenaphthylene	80.000	5071	40512	1	0.05
4	7.12	Acenaphthene	40.000	1132	8280	2	-0.05
5	7.32	Fluorene	8.000	2939	24733	2	0.00
6	7.93	Phenanthrene	4.000	5101	42234	1	0.09
7	8.43	Anthracene	4.000	12017	104199	1	0.00
8	9.17	Fluoranthene	8.000	2224	19612	1	0.00
9	9.58	Pyrene	4.000	719	6084	1	0.00
10	11.20	Benzo(a)anthracen	4.000	2088	19113	2	0.00
11	11.45	Chrysene	4.000	2487	25464	2	0.00
12	12.90	Benzo(b)fluoranth	8.000	4459	45711	1	0.00
13	13.48	Benzo(k)fluoranth	4.000	2140	21986	1	0.00
14	13.95	Benzo(a)pyrene	4.000	1483	15457	1	0.00
15	14.98	Dibenzo(a,h)anthr	8.000	865	8704	2	0.02
16	15.40	Benzo(g,h,i)peryl	8.000	1460	15237	2	0.00
17	15.75	Indenoperylene	4.000	2478	26179	2	0.00
		Totals	232.000	49845	448219		

********** Peak Report: All Peaks **********

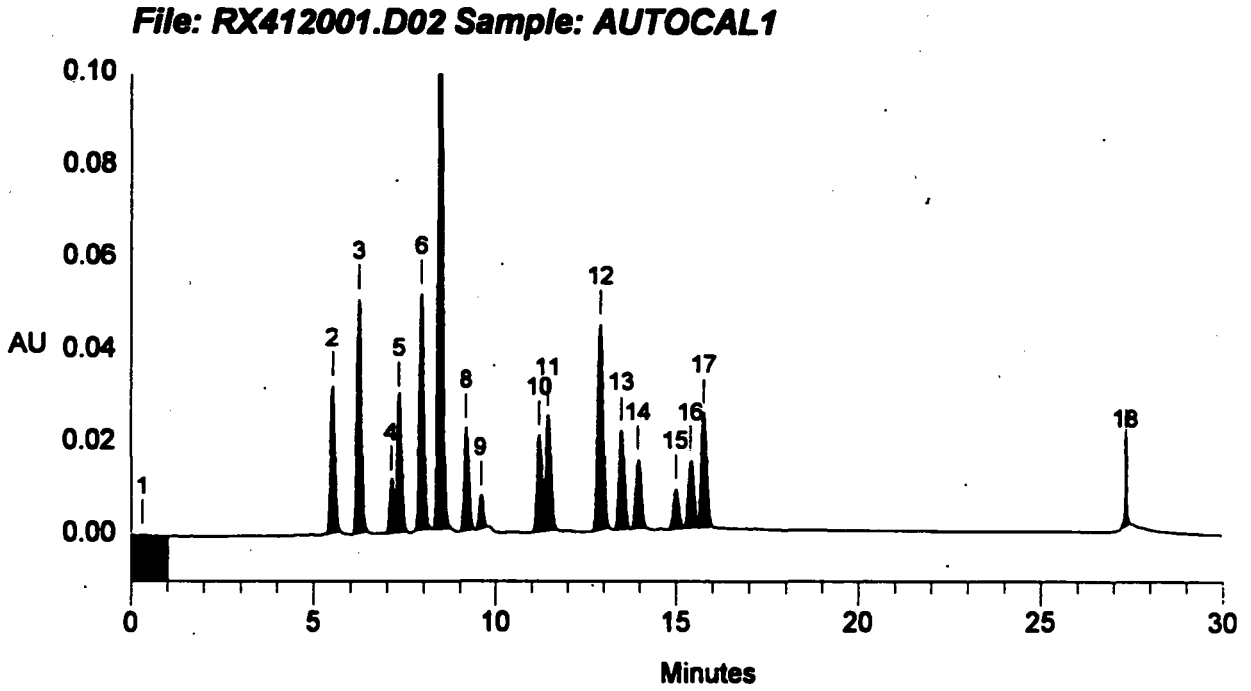
Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delta
1	0.32		0.000	46153	1942243	1	
2	5.52	Naphthalene	40.000	3183	24714	1	-0.06
3	6.23	Acenaphthylene	80.000	5071	40512	1	0.05
4	7.12	Acenaphthene	40.000	1132	8280	2	-0.05
5	7.32	Fluorene	8.000	2939	24733	2	0.00
6	7.93	Phenanthrene	4.000	5101	42234	1	0.09
7	8.43	Anthracene	4.000	12017	104199	1	0.00
8	9.17	Fluoranthene	8.000	2224	19612	1	0.00
9	9.58	Pyrene	4.000	719	6084	1	0.00
10	11.20	Benzo(a)anthracen	4.000	2088	19113	2	0.00
11	11.45	Chrysene	4.000	2487	25464	2	0.00
12	12.90	Benzo(b)fluoranth	8.000	4459	45711	1	0.00
13	13.48	Benzo(k)fluoranth	4.000	2140	21986	1	0.00
14	13.95	Benzo(a)pyrene	4.000	1483	15457	1	0.00
15	14.98	Dibenzo(a,h)anthr	8.000	865	8704	2	0.02
16	15.40	Benzo(g,h,i)peryl	8.000	1460	15237	2	0.00
17	15.75	Indenoperylene	4.000	2478	26179	2	0.00

18	27.32		0.000	1269	5445	1
		Totals	232.000	97266	2395908	

********** Peak Report: Unknown Peaks **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delt
1	0.32		0.000	46153	1942243	1	
18	27.32		0.000	1269	5445	1	
		Totals	0.000	47421	1947688		

#	Group Name	Amount	Area	Area%
1		0.0000	0	0.00%
2		0.0000	0	0.00%
3		0.0000	0	0.00%
4		0.0000	0	0.00%
5		0.0000	0	0.00%
6		0.0000	0	0.00%



Data Reprocessed On 07/31/1993 13:23:39

Sample Name: AUTOCAL2 Date: 04/16/1993 11:34:44
Data File : C:\DX\DATA\RX412001.D03
Method : C:\DX\METHOD\RX412.MET
ACI Address: 1 System: 1 Inject#: 3 Vial: Detector:VDM-2
Analyst : Column:

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	9000	5Hz	0.00	30.00	50

********** Component Report: All Components **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delta
1	5.53	Naphthalene	20.000	1613	12278	1	0.06
2	6.23	Acenaphthylene	40.000	2502	20020	1	0.05
3	7.13	Acenaphthene	20.000	586	4768	2	0.05
4	7.33	Fluorene	4.000	1510	11252	2	0.00
5	7.93	Phenanthrene	2.000	2522	20721	1	-0.00
6	8.43	Anthracene	2.000	6032	51504	1	0.00
7	9.15	Fluoranthene	4.000	1085	9584	1	0.00
8	9.58	Pyrene	2.000	351	2800	1	0.00
9	11.18	Benzo(a)anthracen	2.000	1040	9439	2	0.00
10	11.43	Chrysene	2.000	1247	12416	2	0.00
11	12.87	Benzo(b)fluoranth	4.000	2224	22763	1	0.00
12	13.45	Benzo(k)fluoranth	2.000	1059	10597	1	0.00
13	13.92	Benzo(a)pyrene	2.000	654	6619	1	0.00
14	14.95	Dibenzo(a,h)anthr	4.000	413	3895	1	0.00
15	15.35	Benzo(g,h,i)peryl	4.000	681	7006	2	0.00
16	15.70	Indenoperylene	2.000	1204	12690	2	0.00
		Totals	116.000	24724	218350		

********** Peak Report: All Peaks **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delta
1	5.53	Naphthalene	20.000	1613	12278	1	0.06
2	6.23	Acenaphthylene	40.000	2502	20020	1	0.05
3	7.13	Acenaphthene	20.000	586	4768	2	0.05
4	7.33	Fluorene	4.000	1510	11252	2	0.00
5	7.93	Phenanthrene	2.000	2522	20721	1	-0.00
6	8.43	Anthracene	2.000	6032	51504	1	0.00
7	9.15	Fluoranthene	4.000	1085	9584	1	0.00
8	9.58	Pyrene	2.000	351	2800	1	0.00
9	11.18	Benzo(a)anthracen	2.000	1040	9439	2	0.00
10	11.43	Chrysene	2.000	1247	12416	2	0.00
11	12.87	Benzo(b)fluoranth	4.000	2224	22763	1	0.00
12	13.45	Benzo(k)fluoranth	2.000	1059	10597	1	0.00
13	13.92	Benzo(a)pyrene	2.000	654	6619	1	0.00
14	14.95	Dibenzo(a,h)anthr	4.000	413	3895	1	0.00
15	15.35	Benzo(g,h,i)peryl	4.000	681	7006	2	0.00
16	15.70	Indenoperylene	2.000	1204	12690	2	0.00
17	27.32		0.000	2110	5329	1	

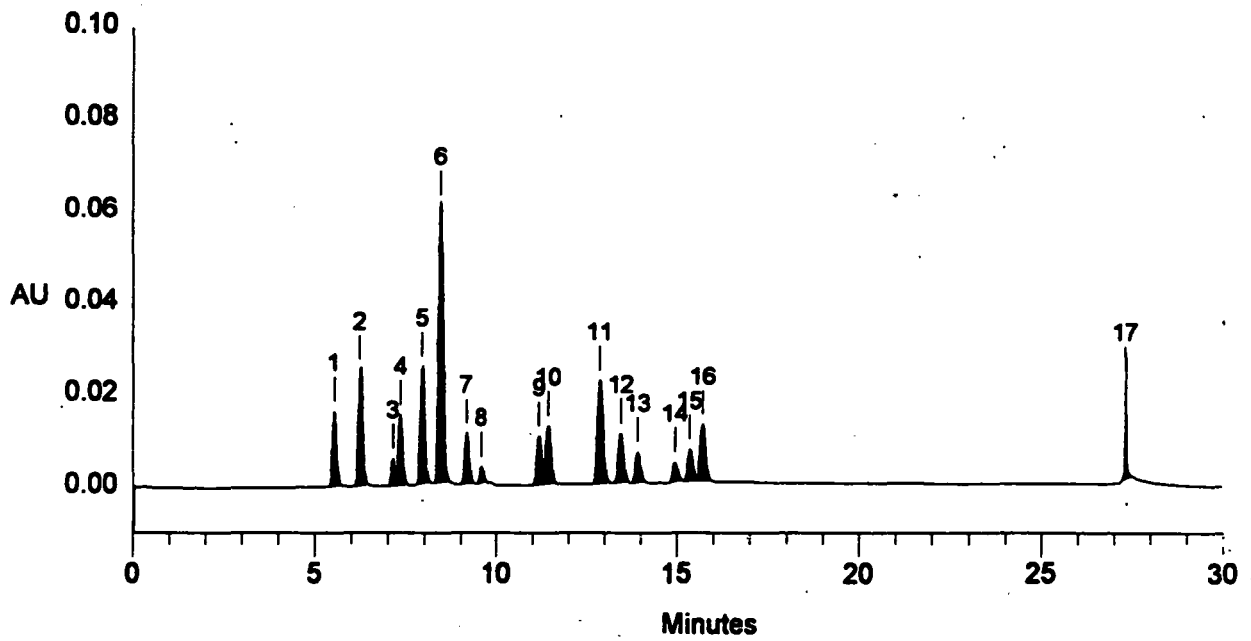
Totals	116.000	26833	223679

********** Peak Report: Unknown Peaks **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delt-
17	27.32		0.000	2110	5329	1	
		Totals	0.000	2110	5329		

#	Group Name	Amount	Area	Area%
1		0.0000	0	0.00%
2		0.0000	0	0.00%
3		0.0000	0	0.00%
4		0.0000	0	0.00%
5		0.0000	0	0.00%
6		0.0000	0	0.00%

File: RX412001.D03 Sample: AUTOCAL2



Data Reprocessed On 07/31/1993 13:22:57

Sample Name: autocal3 Date: 04/16/1993 12:05:22
Data File : C:\DX\DATA\RX412001.D04
Method : C:\DX\METHOD\rx412.met
ACI Address: 1 System: 1 Inject#: 4 Vial: Detector:VDM-2
Analyst : Column:

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	9000	5Hz	0.00	30.00	50

********** Component Report: All Components **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delta
1	5.52	Naphthalene	10.000	774	5891	1	0.00
2	6.23	Acenaphthylene	20.000	1254	9688	1	0.00
3	7.13	Acenaphthene	10.000	291	2179	2	0.00
4	7.32	Fluorene	2.000	722	5896	2	0.00
5	7.92	Phenanthrene	1.000	1222	10276	1	0.00
6	8.43	Anthracene	1.000	3031	25476	1	0.00
7	9.15	Fluoranthene	2.000	548	4798	1	0.00
8	9.57	Pyrene	1.000	183	1528	1	0.00
9	11.17	Benzo(a)anthracen	1.000	511	4591	2	0.00
10	11.42	Chrysene	1.000	613	5892	2	0.00
11	12.83	Benzo(b)fluoranth	2.000	1090	10998	1	0.00
12	13.40	Benzo(k)fluoranth	1.000	509	5104	1	0.00
13	13.88	Benzo(a)pyrene	1.000	299	2914	1	0.00
14	14.91	Dibenzo(a,h)anthr	2.000	213	2094	2	0.00
15	15.32	Benzo(g,h,i)peryl	2.000	334	3340	2	0.00
16	15.67	Indenoperylene	1.000	587	5858	2	0.00
		Totals	58.000	12183	106522		

********** Peak Report: All Peaks **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delta
1	5.52	Naphthalene	10.000	774	5891	1	0.00
2	6.23	Acenaphthylene	20.000	1254	9688	1	0.00
3	7.13	Acenaphthene	10.000	291	2179	2	0.00
4	7.32	Fluorene	2.000	722	5896	2	0.00
5	7.92	Phenanthrene	1.000	1222	10276	1	0.00
6	8.43	Anthracene	1.000	3031	25476	1	0.00
7	9.15	Fluoranthene	2.000	548	4798	1	0.00
8	9.57	Pyrene	1.000	183	1528	1	0.00
9	11.17	Benzo(a)anthracen	1.000	511	4591	2	0.00
10	11.42	Chrysene	1.000	613	5892	2	0.00
11	12.83	Benzo(b)fluoranth	2.000	1090	10998	1	0.00
12	13.40	Benzo(k)fluoranth	1.000	509	5104	1	0.00
13	13.88	Benzo(a)pyrene	1.000	299	2914	1	0.00
14	14.91	Dibenzo(a,h)anthr	2.000	213	2094	2	0.00
15	15.32	Benzo(g,h,i)peryl	2.000	334	3340	2	0.00
16	15.67	Indenoperylene	1.000	587	5858	2	0.00
17	27.32		0.000	2516	5424	1	

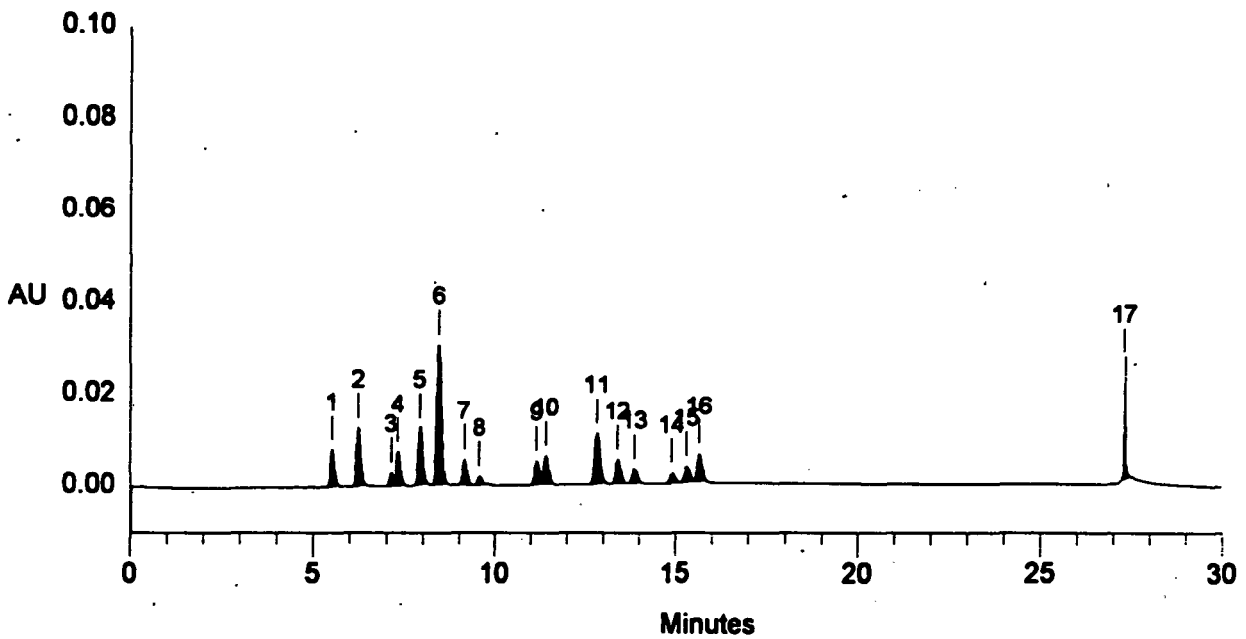
Totals	58.000	14699	111946

********** Peak Report: Unknown Peaks **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delt-
17	27.32		0.000	2516	5424	1	
		Totals	0.000	2516	5424		

#	Group Name	Amount	Area	Area%
1		0.0000	0	0.00%
2		0.0000	0	0.00%
3		0.0000	0	0.00%
4		0.0000	0	0.00%
5		0.0000	0	0.00%
6		0.0000	0	0.00%

File: RX412001.D04 Sample: autocal3



Data Reprocessed On 07/31/1993 13:37:29

Sample Name: Reagent Blank A 4/15/93 Date: 04/16/1993 13:06:41
Data File : C:\DX\DATA\RX412001.D06
Method : C:\DX\METHOD\rx412.met
ACI Address: 1 System: 1 Inject#: 6 Vial: Detector: VDM-2
Analyst : Column:

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	10	9000	5Hz	0.00	30.00	50

********** Component Report: All Components **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delta
0	0.00	Naphthalene	0.000	0	0	0	0.00
0	0.00	Acenaphthylene	0.000	0	0	0	0.00
0	0.00	Acenaphthene	0.000	0	0	0	0.00
0	0.00	Fluorene	0.000	0	0	0	0.00
0	0.00	Phenanthrene	0.000	0	0	0	0.00
0	0.00	Anthracene	0.000	0	0	0	0.00
0	0.00	Fluoranthene	0.000	0	0	0	0.00
0	0.00	Pyrene	0.000	0	0	0	0.00
0	0.00	Benzo(a)anthracen	0.000	0	0	0	0.00
0	0.00	Chrysene	0.000	0	0	0	0.00
0	0.00	Benzo(b)fluoranth	0.000	0	0	0	0.00
0	0.00	Benzo(k)fluoranth	0.000	0	0	0	0.00
0	0.00	Benzo(a)pyrene	0.000	0	0	0	0.00
0	0.00	Dibenzo(a,h)anthr	0.000	0	0	0	0.00
0	0.00	Benzo(g,h,i)peryl	0.000	0	0	0	0.00
0	0.00	Indenoperylene	0.000	0	0	0	0.00
		Totals	0.000	0	0		

********** Peak Report: All Peaks **********

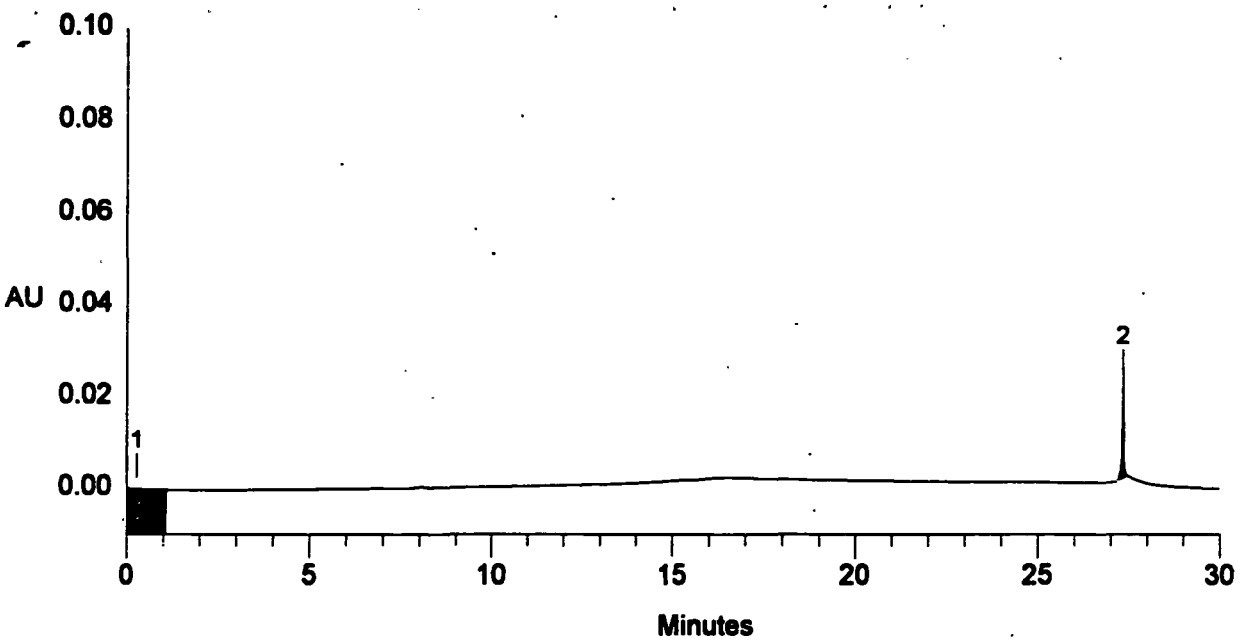
Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delta
1	0.28		0.000	49586	2084570	1	
2	27.32		0.000	2011	5398	1	
		Totals	0.000	51597	2089968		

********** Peak Report: Unknown Peaks **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delta
1	0.28		0.000	49586	2084570	1	
2	27.32		0.000	2011	5398	1	
		Totals	0.000	51597	2089968		

#	Group Name	Amount	Area	Area%
1		0.0000	0	0.00%
2		0.0000	0	0.00%
3		0.0000	0	0.00%
4		0.0000	0	0.00%
5		0.0000	0	0.00%
6		0.0000	0	0.00%

File: RX412001.D06 Sample: Reagent Blank A 4/15/93



Data Reprocessed On 07/31/1993 13:36:46

Sample Name: Reactor 4/12/93 Date: 04/16/1993 12:36:01
Data File : C:\DX\DATA\RX412001.D05
Method : C:\DX\METHOD\rx412.met
ACI Address: 1 System: 1 Inject#: 5 Vial: Detector:VDM-2
Analyst : Column:

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	10	9000	5Hz	0.00	30.00	50

********** Component Report: All Components **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delta
0	0.00	Naphthalene	0.000	0	0	0	0.00
0	0.00	Acenaphthylene	0.000	0	0	0	0.00
2	7.22	Acenaphthene	18.683	104	750	2	1.21
3	7.33	Fluorene	18.605	609	5032	2	0.00
4	7.93	Phenanthrene	17.682	2119	18381	1	-0.99
5	8.43	Anthracene	17.602	5430	45345	2	0.00
7	9.13	Fluoranthene	181.333	4145	44658	2	0.00
8	9.52	Pyrene	166.096	1953	25480	2	0.00
12	11.17	Benzo(a)anthracen	24.219	1061	11477	2	0.00
13	11.38	Chrysene	21.354	1284	13300	2	0.00
16	12.82	Benzo(b)fluoranth	26.959	1423	15102	2	0.00
17	13.40	Benzo(k)fluoranth	11.727	606	6020	1	0.00
18	13.85	Benzo(a)pyrene	27.527	920	10101	1	0.00
19	14.76	Dibenzo(a,h)anthr	19.910	126	1898	1	0.00
20	15.30	Benzo(g,h,i)peryl	17.566	291	2722	2	0.00
21	15.62	Indenoperylene	12.172	750	7353	2	0.00
		Totals	581.437	20820	207618		

********** Peak Report: All Peaks **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delta
1	4.97		0.000	1484	11924	1	
2	7.22	Acenaphthene	18.683	104	750	2	1.21
3	7.33	Fluorene	18.605	609	5032	2	0.00
4	7.93	Phenanthrene	17.682	2119	18381	1	-0.99
5	8.43	Anthracene	17.602	5430	45345	2	0.00
6	8.61		0.000	1678	11841	2	
7	9.13	Fluoranthene	181.333	4145	44658	2	0.00
8	9.52	Pyrene	166.096	1953	25480	2	0.00
9	10.10		0.000	1163	9051	2	
10	10.33		0.000	1833	16217	2	
11	10.95		0.000	494	5804	2	
12	11.17	Benzo(a)anthracen	24.219	1061	11477	2	0.00
13	11.38	Chrysene	21.354	1284	13300	2	0.00
14	12.00		0.000	602	5983	2	
15	12.53		0.000	2805	39097	2	
16	12.82	Benzo(b)fluoranth	26.959	1423	15102	2	0.00
17	13.40	Benzo(k)fluoranth	11.727	606	6020	1	0.00

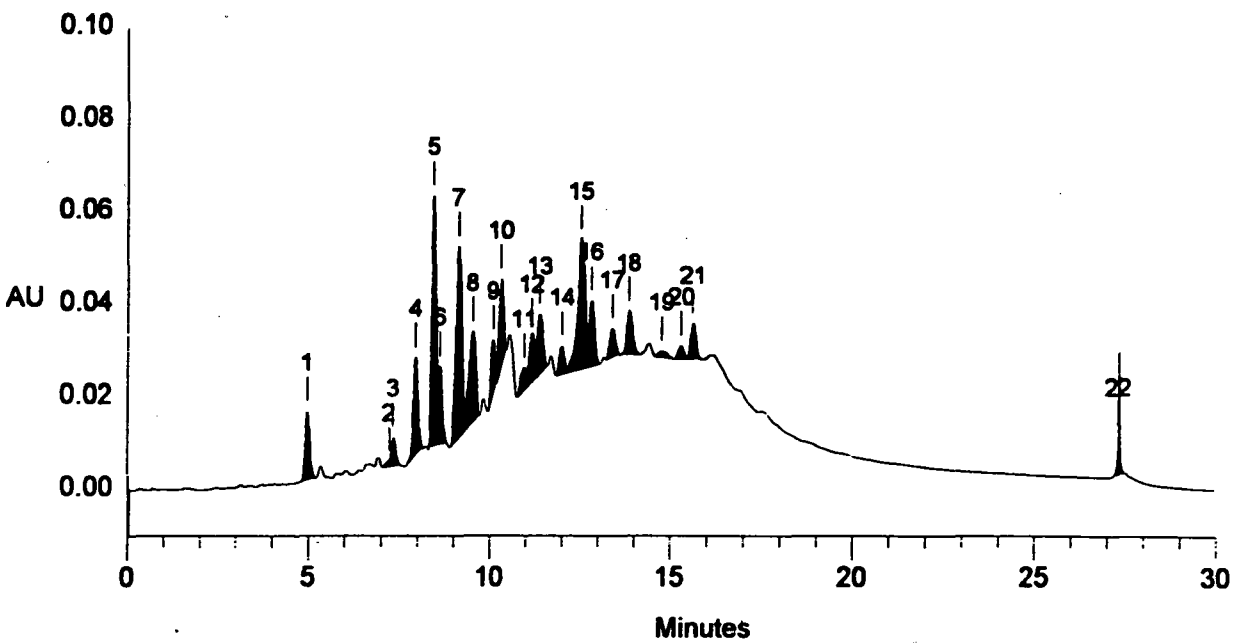
18	13.85	Benzo(a)pyrene	27.527	920	10101	1	0.0(
19	14.76	Dibenzo(a,h)anthr	19.910	126	1898	1	0.0(
20	15.30	Benzo(g,h,i)peryl	17.566	291	2722	2	0.00
21	15.62	Indenoperylene	12.172	750	7353	2	0.0(
22	27.32		0.000	816	5700	1	
		Totals	581.437	31697	313235		

********** Peak Report: Unknown Peaks **********

Pk. Num	Ret Time	Component Name	Concentration ug/ml	Height	Area	Bl. Code	%Delt
1	4.97		0.000	1484	11924	1	
6	8.61		0.000	1678	11841	2	
9	10.10		0.000	1163	9051	2	
10	10.33		0.000	1833	16217	2	
11	10.95		0.000	494	5804	2	
14	12.00		0.000	602	5983	2	
15	12.53		0.000	2805	39097	2	
22	27.32		0.000	816	5700	1	
		Totals	0.000	10877	105617		

#	Group Name	Amount	Area	Area%
1		0.0000	0	0.00%
2		0.0000	0	0.00%
3		0.0000	0	0.00%
4		0.0000	0	0.00%
5		0.0000	0	0.00%
6		0.0000	0	0.00%

File: RX412001.D05 Sample: Reactor 4/12/93



Roy F. Weston - HPLC Run Log

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
1/5/93	4:58	Autocal 1	STD/25	West0041.D01	PAH	JR	Supelco Mix 610-M Lot No. LA 33993	A
1/5/93	5:29	Autocal 2	STD/50	West0021.D02	PAH	JR	Supelco Mix 610-M Lot No. LA 33993	A
1/5/93	5:59	Autocal 3	STD/100	West0021.D03	PAH	JR	Supelco Mix 610-M Lot No. LA 33993	A
1/5/93	6:30	Weston #1	T0 Bottel 1	West0021.D04	PAH	JR	Notebook 92-18; pg. 40-41	A
1/5/93	7:00	Weston #1 dup	T0 bottle 1 Dup	West0021.D05	PAH	JR	Notebook 92-18; pg. 40-41	A
1/5/93	7:31	Weston #2	T0 bottle 2	West0021.D06	PAH	JR	Notebook 92-18; pg. 40-41	A
1/5/93	8:02	Weston #2 dup	T0 bottle 2 Dup	West0021.D07	PAH	JR	Notebook 92-18; pg. 40-41	A
1/5/93	8:32	Weston #3	T0 bottle 3	West0011.D08	PAH	JR	Notebook 92-18; pg. 40-41	A
1/5/93	9:03	Weston #4	T0 bottle 4	West011.D09	PAH	JR	Notebook 92-18; pg. 40-41	A
1/19/93	3:27	Autocal 1	STD/25	WestT301.D01	PAH	TS	Supelco Mix 610-M Lot No. LA 33993	B
1/19/93	3:57	Autocal 2	STD/50	WestT301.D02	PAH	TS	Supelco Mix 610-M Lot No. LA 33993	B
1/19/93	4:28	Autocal 3	STD/100	WestT301.D03	PAH	TS	Supelco Mix 610-M Lot No. LA 33993	B
1/19/93	4:59	Weston #1	3 week bottle 1	WestT301.D04	PAH	TS	Notebook 92-18; pg. 40-41	B
1/19/93	5:29	Weston #1 dup	3 week bottle 1 Dup	WestT301.D05	PAH	TS	Notebook 92-18; pg. 40-41	B
1/19/93	6:00	Weston #2	3 week bottle 2	WestT301.D06	PAH	TS	Notebook 92-18; pg. 40-41	B
1/19/93	6:30	Weston #2 dup	3 week bottle 2 Dup	WestT301.D07	PAH	TS	Notebook 92-18; pg. 40-41	B

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
1/19/93	7:01	Weston #3	3 week bottle 3	WestT301.D08	PAH	TS	Notebook 92-18; pg. 40-41	B
1/19/93	7:32	Weston #4	3 week bottle 4	WestT301.D09	PAH	TS	Notebook 92-18; pg. 40-41	B
2/3/93	2:42	Autocal 1	STD/25	WestRxT1.D01	PAH	TS	Supelco Mix 610-M; Lot No. LA 33993	F
2/3/93	3:12	Autocal 2	STD/50	WestRxT1.D02	PAH	TS	Supelco Mix 610-M; Lot No. LA 33993	F
2/3/93	3:43	Autocal 3	STD/100	WestRxT1.D03	PAH	TS	Supelco Mix 610-M; Lot No. LA 33993	F
2/3/93	4:14	RAS/T0	1/27 RAS	WestRxT1.D04	PAH	TS	Chromatogram misnamed as influent/T0	F
2/3/93	4:44	Reactor/T0	1/27 Rx	WestRxT1.D05	PAH	TS	Chromatogram misnamed as influent/T0	F
2/3/93	5:15	Inf/T0	1/27 inf	WestRxT1.D06	PAH	TS	Chromatogram misnamed as RAS/T0	F
2/3/93	5:46	ACN	instrument blank	WestRxT1.D07	PAH	TS	Chromatogram misnamed as RAS/T0	F
2/4/93	3:12	Autocal 1	STD/25	WestRx01.D01	PAH	JR	Supelco Mix 610-M; Lot No. LA 33993	G
2/4/93	3:43	Autocal 2	STD/50	WestRx01.D02	PAH	JR	Supelco Mix 610-M; Lot No. LA 33993	G
2/4/93	4:14	Autocal 3	STD/100	WestRx01.D03	PAH	JR	Supelco Mix 610-M; Lot No. LA 33993	G
2/4/93	4:44	Influent/T1	2/1 Inf	WestRx01.D04	PAH	JR	Notebook 93-01; pg 27	G
2/4/93	5:15	Reactor/T1	2/1 Rx	WestRx01.D05	PAH	JR	Notebook 93-01; pg 27	G
2/4/93	5:45	RAS/T1	2/1 RAS	WestRx01.D06	PAH	JR	Notebook 93-01; pg 27	G
2/4/93	6:16	ACN	instrument blank	WestRx01.D07	PAH	JR	Notebook 93-01; pg 27	G

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
2/5/93	5:05	Atuocal 1	STD/25	Westbat1.D01	PAH	JR	Supelco Mix 610-M; Lot No. LA 33993	C
2/5/93	5:35	Autocal 2	STD/50	Westbat1.D02	PAH	JR	Supelco Mix 610-M; Lot No. LA 33993	C
2/5/93	6:06	Autocal 3	STD/100	Westbat1.D03	batch	JR	Supelco Mix 610-M; Lot No. LA 33993	C
2/5/93	6:37	Weston #1/T6	6 week bottle 1	Westbat1.D04	batch	JR	Notebook 92-18; pg 73	C
2/5/93	7:07	Weston #1 dup/T6	6 week bottle 1 dup	Westbat1.D05	batch	JR	Notebook 92-18; pg 73	C
2/5/93	7:38	Weston #2/T6	6 week bottle 2	Westbat1.D06	batch	JR	Notebook 92-18; pg 73	C
2/5/93	8:08	Weston #2 dup/T6	6 week bottle 2 dup	Westbat1.D07	batch	JR	Notebook 92-18; pg 73	C
2/5/93	8:39	Weston #3/T6	6 week bottle 3	Westbat1.D08	batch	JR	Notebook 92-18; pg 73	C
2/5/93	9:10	Weston #4/T6	6 week bottle 4	Westbat1.D09	batch	JR	Notebook 92-18; pg 73	C
2/5/93	9:40	ACN	instrument blank	Westbat1.D10	PAH	JR	Notebook 92-18; pg 73	C
2/10/93	22:40	Autocal 1	STD/25	QASPIKJ1.D01	West	TS	Supelco Mix 610-M; Lot No. LA 33993	H
2/10/93	23:11	Autocal 2	STD/50	QASPIKH1.D02	West	TS	Supelco Mix 610-M; Lot No. LA 33993	H
2/11/93	6:29	Autocal 3	STD/100	QASPIKE1.D03	West	TS	Supelco Mix 610-M; Lot No. LA 33993	H
2/11/93	6:59	#1 T3 Spike A	matrix spike	QASPIKE1.D04	West	TS	Notebook 92-18; pg 69	H
2/11/93	7:30	#1 T3 Spike B	matrix spike	QASPIKE1.D05	West	TS	Notebook 92-18; pg 69	H
2/11/93	8:01	#1 T3 Spike C	matrix spike	QASPIKE1.D06	West	TS	Notebook 92-18; pg 69	H
2/11/93	8:31	#1 T3 A	unspiked sample	QASPIKE1.D07	West	TS	Notebook 92-18; pg 69	H
2/11/93	9:02	#1 T3 B	unsiked sample	QASPIKE1.D08	West	TS	Notebook 92-18; pg 69	H
2/11/93	10:03	Influent 2/4/93		WestRx01.D10	West	TS	Notebook 93-01; pg 32	H
2/11/93	10:34	Reactor 2/4/93		WestRx01.D11	West	TS	Notebook 93-01; pg 32	H
2/11/93	11:04	Influent 2/8/93		WestRx01.D12	West	TS	Notebook 93-01; pg 32	H

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
2/11/93	11:35	Reactor 2/8/93		WestRx01.D13	West	TS	Notebook 93-01; pg 32	H
2/11/93	12:06	RAS 2/8/93		WestRx01.D14	West	TS	Notebook 93-01; pg 32	H
2/11/93	12:36	ACN	instrument blank	WestRx01.D15	West	TS	Notebook 93-01; pg 32	H
2/16/93	21:36	Autocal 1	STD/25	Spike011.D01	Spike	JR	Supleco Mix 610-M; Lot No. LA 33993	E
2/16/93	22:07	Autocal 2	STD/50	Spike011.D02	Spike	JR	Supelco Mix 610-M; Lot No. LA 33993	E
2/16/93	22:38	Autocal 3	STD/100	Spike011.D03	Spike	JR	Supelco Mix 610-M; Lot No. LA 33993	E
2/16/93	23:08	PAH spike std/1000A	spike std	Spike011.D04	Spike	JR	Notebook 92-18; pg 69	E
2/16/93	23:39	PAH spike std/1000B	spike std	Spike011.D05	Spike	JR	Notebook 92-18; pg 69	E
2/17/93	00:10	PAH spike std/1000C	spike std	Spike011.D06	Spike	JR	Notebook 92-18; pg 69	E
2/17/93	5:19	Autocal 1	STD/25	Rx211001.001	Rx211	JR	Supelco Mix 610-M; Lot No. LA 33993	I
2/17/93	5:50	Autocal 2	STD/50	Rx211001.002	Rx211	JR	Supelco Mix 610-M; Lot No. LA 33993	I
2/17/93	6:20	Autocal 3	STD/100	Rx211001.003	Rx211	JR	Supelco Mix 610-M; Lot No. LA 33993	I
2/17/93	6:51	Influent/2/11		Rx211001.004	Rx211	JR	Notebook 93-01; pg 37	I
2/17/93	7:22	Reactor/2/11		Rx211001.005	Rx211	JR	Notebook 93-01; pg 37	I
2/17/93	7:52	ACN	instrument blank	Rx211001.006	Rx211	JR	Notebook 93-01; pg 37	I
2/18/93	1:53	Autocal 1	STD/25	Rx215001.D01	Rx215	TS	Supelco Mix 610-M; Lot No. LA 33993	J
2/18/93	2:24	Autocal 2	STD/50	Rx215001.D02	Rx215	TS	Supelco Mix 610-M; Lot No. LA 33993	J

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
2/18/93	2:55	Autocal 3	STD/100	Rx215001.D03	Rx215	TS	Supelco Mix 610-M; Lot No. LA 33993	J
2/18/93	3:25	Influent/2/15		Rx215001.D04	Rx215	TS	Notebook 93-01; pg 38 Chromatogram misnamed Reactor 2/11	J
2/18/93	3:56	Reactor/2/15		Rx215001.D05	Rx215	TS	Notebook 93-01; pg 38 Chromatogram misnamed Reactor 2/11	J
2/18/93	4:27	RAS/2/15		Rx215001.D06	Rx215	TS	Notebook 93-01; pg 38 Chromatogram misnamed Reactor 2/11	J
2/18/93	4:57	ACN	instrument blank	Rx215001.D07	Rx215	TS	Notebook 93-01; pg 38 Chromatogram misnamed Reactor 2/11	J
2/19/93	16:41	Autocal 1	STD/25	Extract1.D01	Extract	TS	Supelco Mix 610-M; Lot No. LA 33993	D
2/19/93	17:12	Autocal 2	STD/50	Extract1.D02	Extract	TS	Supelco Mix 610-M; Lot No. LA 33993	D
2/19/93	17:42	Autocal 3	STD/100	Extract1.D03	Extract	TS	Supelco Mix 610-M; Lot No. LA 33993	D
2/19/93	18:13	#1 glass extract	bottle extract 1	Extract1.D04	Extract	TS	Notebook 92-18; pg 75	D
2/19/93	18:43	#1 dup glass extract	bottle extract 1 dup	Extract1.D05	Extract	TS	Notebook 92-18; pg 75	D
2/19/93	19:14	#2 glass extract	bottle extract 2	Extract1.D06	Extract	TS	Notebook 92-18; pg 75	D
2/19/93	19:45	#2 dup glass extract	bottle extract 2 dup	Extract1.D07	Extract	TS	Notebook 92-18; pg 75	D
2/19/93	20:15	#3 glass extract	bottle extract 3	Extract1.D08	Extract	TS	Notebook 92-18; pg 75	D
2/19/93	20:46	#4 glass extract	bottle extract 4	Extract1.D09	Extract	TS	Notebook 92-18; pg 75	D
2/19/93	21:16	ACN	instrument blank	Extract1.D10	Extract	TS	Notebook 92-18; pg 75	D
2/25/93	14:52	Autocal 1	STD/25	Rx218041.D01	Rx218	JR	Supelco Mix 610-M; Lot No. LA 33993	K

Date Analyzed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
2/25/93	15:22	Autocal 2	STD/50	Rx218041.D02	Rx218	JR	Supelco Mix 610-M; Lot No. LA 33993	K
2/25/93	15:53	Autocal 3	STD/100	Rx218041.D03	Rx218	JR	Supelco Mix 610-M; Lot No. LA 33993	K
2/25/93	18:24	Influent/2/18		Rx218001.D04	Rx218	JR	Notebook 93-01; pg 45	K
2/25/93	18:55	Reactor/2/18		Rx218001.D05	Rx218	JR	Notebook 93-01; pg 45	K
2/25/93	19:25	ACN	instrument blank	Rx218001.D06	Rx218	JR	Notebook 93-01; pg 45	K
3/12/93	17:15	Autocal 1	STD/25	Rx340001.D01	Rx34	TSS	Supelco Mix 610-M; Lot No. LA 33993	L
3/12/93	17:45	Autocal 2	STD/50	Rx340001.D02	Rx34	TSS	Supelco Mix 610-M; Lot No. LA 33993	L
3/12/93	18:16	Autocal 3	STD/100	Rx340001.D03	Rx34	TSS	Supelco Mix 610-M; Lot No. LA 33993	L
3/12/93	18:47	Influent 2/22		Rx340001.D04	Rx34	TSS	Notebook 93-01: pg 56	L
3/12/93	19:17	Reactor 2/22		Rx340001.D05	Rx34	TSS	Notebook 93-01: pg 56	L
3/12/93	19:48	RAS 2/22		Rx340001.D06	Rx34	TSS	Notebook 93-01: pg 56	L
3/12/93	20:19	Influent 2/25		Rx340001.D07	Rx34	TSS	Notebook 93-01: pg 57	L
3/12/93	20:49	Reactor 2/25		Rx340001.D08	Rx34	TSS	Notebook 93-01: pg 57	L
3/12/93	21:20	Influent 3/1		Rx340001.D09	Rx34	TSS	Notebook 93-01: pg 57	L
3/12/93	21:50	Reactor 3/1		Rx340001.D10	Rx34	TSS	Notebook 93-01: pg 57	L
3/12/93	22:21	RAS 3/1		Rx340001.D11	Rx34	TSS	Notebook 93-01: pg 57	L
3/12/93	22:52	Influent 3/4		Rx340001.D12	Rx34	TSS	Notebook 93-01: pg 58	L
3/12/93	23:22	Reactor 3/4		Rx340001.D13	Rx34	TSS	Notebook 93-01: pg 58	L
3/12/93	23:53	ACN	instrument blank	Rx340001.D14	Rx34	TSS	Notebook 93-01: pg 58	L
3/17/93	18:01	Autocal 1	STD/25	RX317001.D01	RX317	JR	Supelco 610-N PAH Mix Lot No. LA33993	M

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
3/17/93	18:31	Autocal 2	STD/50	RX317001.D02	RX317	JR	Supelco 610-N PAH Mix Lot No. LA33993	M
3/17/93	19:02	Autocal 3	STD/100	RX317001.D03	RX317	JR	Supelco 610-N PAH Mix Lot No. LA33993	M
3/17/93	19:33	Influent 3/8		RX317001.D04	RX317	JR	Notebook 93-01; pg. 61	M
3/17/93	20:03	Reactor 3/8/10		RX317001.D05	RX317	JR	Notebook 93-01; pg. 61	M
3/17/93	21.05	RAS 3/8		RX317001.D06	RX317	JR	Notebook 93-01; pg. 61	M
3/18/93	16:59	Autocal 1	STD/25	Spiker X1.D01	Spiker X	JR	Supelco Mix 610-M Lot No. LA33993	R
3/18/93	17:30	Autocal 2	STD/50	Spiker X1.D02	Spiker X	JR	Supelco Mix 610-M Lot No. LA33993	R
3/18/93	18:00	Autocal 3	STD/100	Spiker X1.D03	Spiker X	JR	Supelco Mix 610-M Lot No. LA33993	R
3/18/93	18:31	Spike A 3/8	matrix spike	Spiker X1.D04	Spiker X	JR	Notebook 93-01; pg. 62	R
3/18/93	19:01	Spike B 3/8	matrix spike	Spiker X1.D05	Spiker X	JR	Notebook 93-01; pg. 62	R
3/18/93	19:32	Spike C 3/8	matrix spike	Spiker X1.D06	Spiker X	JR	Notebook 93-01; pg. 62	R
3/18/93	20:03	PAH Spike/200A	spike STD	Spiker X1.D07	Spiker X	JR	Notebook 93-01; pg. 62	R
3/18/93	20:33	PAH Spike/200B	spike STD	Spiker X1.D08	Spiker X	JR	Notebook 93-01; pg. 62	R
3/18/93	21:04	PAH Spike/200C	spike STD	Spiker X1.D09	Spiker X	JR	Notebook 93-01; pg. 62	R
3/18/93	21:34	Reactor 3/8/100	unspiked sample	Spiker X1.D010	Spiker X	JR	Notebook 93-01; pg. 62	R
3/18/93	22:05	ACN	instrument blank	Spiker X1.D011	Spiker X	JR	Notebook 93-01; pg. 62	R
3/20/93	15:08	Autocal 1	STD/25	RX311001.D01	Rx311	JR	Supelco Mix 610-17 Lot No. LA33993	S
3/20/93	15:39	Autocal 2	STD/50	RX311001.D02	Rx311	JR	Supelco Mix 610-17 Lot No. LA33993	S
3/20/93	16:09	Autocal 3	STD/100	RX311001.D03	Rx311	JR	Supelco Mix 610-17 Lot No. LA33993	S

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
3/20/93	16:40	Influent 3/11		Rx311001.D04	Rx311	JR	Notebook 93-01; pg. 64	S
3/20/93	17:11	Reactor 3/11		Rx311001.D05	Rx311	JR	Notebook 93-01; pg. 64	S
3/20/93	17:41	Influent 3/15		Rx311001.D06	Rx311	JR	Notebook 93-01; pg. 64	S
3/20/93	18:12	Reactor 3/15		Rx311001.D07	Rx311	JR	Notebook 93-01; pg. 64	S
3/20/93	18:43	RAS 3/15		Rx311001.D08	Rx311	JR	Notebook 93-01; pg. 64	S
3/20/93	19:13	ACN	instrument blank	Rx311001.D09	Rx311	JR	Notebook 93-01; pg. 64	S
3/30/93	10:44	Autocal 1	STD/25	Rx318011.D01	Rx318	TS	Supelco Mix 610-M Lot LA33993	T
3/30/93	11:15	Autocal 2	STD/50	Rx318011.D02	Rx318	TS	Supelco Mix 610-M Lot LA33993	T
3/30/93	11:45	Autocal 3	STD/100	Rx318011.D03	Rx318	TS	Supelco Mix 610-M Lot LA33993	T
3/30/93	12:16	Rx318	Reactor 3/18	Rx318011.D04	Rx318	TS	Notebook 93-01; pg. 75	T
3/30/93	12:47	RAS 318		Rx318011.D05	Rx318	TS	Notebook 93-01; pg. 75	T
3/30/93	13:48	ACN	instrument blank	Rx318011.D06	Rx318	TS	Notebook 93-01; pg. 75	T
3/30/93	15:37	Autocal 1	STD/25	RX322001.D01	RX322	TS	Supelco 610-M PAH Mix Lot Not LA33993	N
3/30/93	16:08	Autocal 2	STD/50	RX322001.D02	RX322	TS	Supelco 610-M PAH Mix Lot Not LA33993	N
3/30/93	16:39	Autocal 3	STD/100	RX322001.D03	RX322	TS	Supelco 610-M PAH Mix Lot Not LA33993	N
3/30/93	17:09	RX322	Reactor 3/22	RX322001.D04	RX322	TS	Notebook 93-01; pg. 75	N
3/30/93	17:40	Influent 322		RX322001.D05	RX322	TS	Notebook 93-01; pg. 75	N
3/30/93	18:11	Influent 318		RX322001.D06	RX322	TS	Notebook 93-01; pg. 75	N
3/30/93	18:41	ACN	instrument blank	RX322001.D07	RX322	TS	Notebook 93-01; pg. 75	N

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
3/31/93	9:00	Autocal 1	STD/25	Respike 1.D01	Respike	TS	Supelco Mix 610-M Lot #LA33993	U
3/31/93	9:31	Autocal 2	STD/50	Respike 1.D02	Respike	TS	Supelco Mix 610-M Lot #LA33993	U
3/31/93	10:02	Autocal 3	STD/100	Respike 1.D03	Respike	TS	Supelco Mix 610-M Lot #LA33993	U
3/31/93	10:32	Rx 3/19 Spike A	Matrix Spike	Respike 1.D04	Respike	TS	Notebook 93-01; pg. 78	U
3/31/93	11:03	Rx 3/19 spike B	Matrix Spike	Respike 1.D05	Respike	TS	Notebook 93-01; pg. 78	U
3/31/93	11:34	Rx 3/19 Spike C	Matrix Spike	Respike 1.D06	Respike	TS	Notebook 93-01; pg. 78	U
3/31/93	12:04	Rx 3/19	Unspiked Sample	Respike 1.D07	Respike	TS	Notebook 93-01; pg. 78	U
3/31/93	12:35	PAH Spike STD/200	Spike STD	Respike 1.D08	Respike	TS	Notebook 93-01; pg. 78	U
3/31/93	13:06	PAH Spike STD/200	Spike STD	Respike 1.D09	Respike	TS	Notebook 93-01; pg. 78	U
3/31/93	13:36	PAH Spike STD/200	Spike STD	Respike 1.D010	Respike	TS	Notebook 93-01; pg. 78	U
3/31/93	14:07	ACN	instrument blank	Respike 1.D011	Respike	TS	Notebook 93-01; pg. 78	U
4/1/93	16:00	Autocal 1	STD/25	RX329001.D01	RX329	JR	Supelco 610-N PAH Mix Lot No. LA33993	P
4/1/93	16:30	Autocal 2	STD/50	RX329001.D02	RX329	JR	Supelco 610-N PAH Mix Lot No. LA33993	P
4/1/93	17:01	Autocal 3	STD/100	RX329001.D03	RX329	JR	Supelco 610-N PAH Mix Lot No. LA33993	P
4/1/93	17:32	Influent 3/29/93		RX329001.D04	RX329	JR	Notebook 93-01; pg. 80	P
4/1/93	18:02	Reactor 3/29/93		RX329001.D05	RX329	JR	Notebook 93-01; pg. 80	P
4/1/93	18:33	RAS 3/29/93		RX329001.D06	RX329	JR	Notebook 93-01; pg. 80	P
4/1/93	19:04	ACN		RX329001.D07	RX329	JR	Notebook 93-01; pg. 80	P
4/3/93	12:12	Autocal 1	STD/25	RX325B01.D02	RX325B	TS	Supelco Mix 610-M Lot No. LA 33993	O

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
4/3/93	12:43	Autocal 2	STD/50	RX325B01.D03	RX325B	TS	Supelco Mix 610-M Lot No. LA 33993	O
4/3/93	13:15	Autocal 3	STD/100	RX325B01.D04	RX325B	TS	Supelco Mix 610-M Lot No. LA 33993	O
4/3/93	13:48	Influent 3/25/93		RX325B01.D05	RX325B	TS	Notebook 93-01; pg. 80	O
4/3/93	14:20	Reactor 3/25/93		RX325B01.D06	RX325B	TS	Notebook 93-01; pg. 80	O
4/3/93	14:52	RAS 3/25/93		RX325B01.D07	RX325B	TS	Notebook 93-01; pg. 80	O
4/5/93	15:57	Autocal 1	STD/25	Rx420001.D01	Rx42	TS	Supelco 610-M Lot No. LA33993	V
4/5/93	16:28	Autocal 2	STD/50	Rx420001.D02	Rx42	TS	Supelco 610-M Lot No. LA33993	V
4/5/93	16:58	Autocal 3	STD/100	Rx420001.D03	Rx42	TS	Supelco 610-M Lot No. LA33993	V
4/5/93	17:29	Influent 4/1		Rx420001.D04	Rx42	TS	Notebook 93-01; pg. 83	V
4/5/93	18:00	Reactor 4/1		Rx420001.D05	Rx42	TS	Notebook 93-01; pg. 83	V
4/5/93	18:30	Reactor 4/2		Rx420001.D06	Rx42	TS	Notebook 93-01; pg. 83	V
4/5/93	19:01	Reagent blank A 4/2		Rx420001.D07	Rx42	TS	Notebook 93-01; pg. 84	V
4/5/93	19:31	Reagent blank B 4/2		Rx420001.D08	Rx42	TS	Notebook 93-01; pg. 84	V
4/5/93	20:02	Reagent blank C 4/2		Rx420001.D09	Rx42	TS	Notebook 93-01; pg. 84	V
4/5/93	20:33	ACN	instrument blank	Rx420001.D010	Rx42	TS	Notebook 93-01; pg. 84	V
4/6/93	10:36	Autocal 1	STD/25	Rx460001.D01	Rx46	JR	Supelco 610-M Lot No. LA33993	W
4/6/93	11:07	Autocal 2	STD/50	Rx460001.D02	Rx46	JR	Supelco 610-M Lot No. LA33993	W
4/6/93	11:37	Autocal 3	STD/100	Rx460001.D03	Rx46	JR	Supelco 610-M Lot No. LA33993	W
4/6/93	12:08	Blank A 4/6		Rx460001.D04	Rx46	JR	Notebook 93-01; pg. 92	W

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
4/6/93	12:38	Blank B 4/6		Rx460001.D05	Rx46	JR	Notebook 93-01; pg. 92	W
4/6/93	13:14	Blank C 4/6		Rx460001.D06	Rx46	JR	Notebook 93-01; pg. 92	W
4/6/93	13:45	ACN	instrument blank	Rx460001.D07	Rx46	JR	Notebook 93-01; pg. 92	W
4/7/93	14:35	Autocal 1	STD/25	Rx470001.D01	Rx47	JR	Supelco 610-M Lot No. LA-33993	X
4/7/93	15:06	Autocal 2	STD/50	Rx470001.D02	Rx47	JR	Supelco 610-M Lot No. LA-33993	X
4/7/93	15:36	Autocal 3	STD/100	Rx470001.D03	Rx47	JR	Supelco 610-M Lot No. LA-33993	X
4/7/93	16:07	Blank A 4/7		Rx470001.D04	Rx47	JR	Notebook 93-01; pg. 92	X
4/7/93	16:37	Blank B 4/7		Rx470001.D05	Rx47	JR	Notebook 93-01; pg. 92	X
4/7/93	17:08	Blank C 4/7		Rx470001.D06	Rx47	JR	Notebook 93-01; pg. 92	X
4/13/93	12:52	Autocal 1	STD/25	RX480001.D01	RX48	JR	Supelco Mix 610-M Lot No. LA33993	Q
4/13/93	13:22	Autocal 2	STD/50	RX480001.D02	RX48	JR	Supelco Mix 610-M Lot No. LA33993	Q
4/13/93	13:53	Autocal 3	STD/100	RX480001.D03	RX48	JR	Supelco Mix 610-M Lot No. LA33993	Q
4/13/93	14:24	Reactor 4/1/93	unspiked sample	RX480001.D04	RX48	JR	Notebook 93-01; pg. 83	Q
4/13/93	14:54	Reactor 4/5/93		RX480001.D05	RX48	JR	Notebook 93-01; pg. 2	Q
4/13/93	15:25	Reactor 4/8/93		RX480001.D06	RX48	JR	Notebook 93-01; pg. 2	Q
4/13/93	15:56	Spike STD	spike std	RX480001.D07	RX48	JR	Notebook 93-01; pg. 2	Q
4/13/93	16:26	Spike STD	spike std	RX480001.D08	RX48	JR	See pg. 3 Book 93-04	Q
4/13/93	16:57	Spike STD	spike std	RX480001.D09	RX48	JR	See pg. 3 Book 93-04	Q
4/13/93	17:5	Spike A 4/1/93	matrix spike	RX480001.D010	RX48	JR	See pg. 3 Book 93-04	Q
4/13/93	17:58	Spike B 4/1/93	matrix spike	RX480001.D011	RX48	JR	See pg. 3 Book 93-04	Q

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
4/13/93	18:29	Spike C 4/1/93	matrix spike	RX480001.D012	RX48	JR	See pg. 3 Book 93-04	Q
4/13/93	19:00	ACN	instrument blank	RX48001.D013	RX48	JR	See pg. 3 Book 93-04	Q
4/16/93	11:00	Autocal 1	STD/25	Rx412001.D02	Rx412	JR	Supelco 610-Mix Lot No. LA33993	
4/16/93	11:34	Autocal 2	STD/50	Rx412001.D03	Rx412	JR	Supelco 610-Mix Lot No. LA33993	
4/16/93	12:05	Autocal 3	STD/100	Rx412001.D04	Rx412	JR	Supelco 610-Mix Lot No. LA33993	
4/16/93	12:36	Rx 4/12		Rx412001.D05	Rx412	JR	Notebook 93-04; pg. 2	
4/16/93	13:06	Reagent blank A 4/15		Rx412001.D06	Rx412	JR	Notebook 93-04; pg. 6	
4/16/93	13:37	Reagent blank B 4/15		Rx412001.D07	Rx412	JR	Notebook 93-04; pg. 2	
4/16/93	14:07	Reagent Blank C 4/15		Rx412001.D08	Rx412	JR	Notebook 93-04; pg. 6	
4/19/93	15:27	Autocal 1	STD/25	Rx415001.D01	Rx415	JR	Supelco PAH Mix Lot No. LA 33993	
4/19/93	15:57	Autocal 2	STD/50	Rx415001.D02	Rx415	JR	Supelco PAH Mix Lot No. LA 33993	
4/19/93	16:28	Autocal 3	STD/100	Rx415001.D03	Rx415	JR	Supelco PAH Mix Lot No. LA 33993	
4/19/93	16:59	Rx 4/15		Rx415001.D04	Rx415	JR	Notebook 93-04; pg. 10	
4/19/93	17:29	Spike A 4/8	Matrix spike 4/8	Rx415001.D05	Rx415	JR	Notebook 93-04; pg. 11	
4/19/93	18:00	Spike B 4/8	Matrix spike 4/8	Rx415001.D06	Rx415	JR	Notebook 93-04; pg. 11	
4/19/93	18:31	Spike C 4/8	Matrix spike 4/8	Rx415001.D07	Rx415	JR	Notebook 93-04; pg. 11	
4/19/93	19:01	Rx4/8	Unspiked sample	Rx415001.D08	Rx415	JR	Notebook 93-04; pg. 11	
4/19/93	19:32	Spike STD A	Spike std	Rx415001.D09	Rx415	JR	Notebook 93-04; pg. 11	
4/19/93	20:03	Spike STD B	Spike STD	Rx415001.D010	Rx415	JR	Notebook 93-04; pg. 11	
4/19/93	20:33	Spike STD C	Spike STD	Rx415001.D011	Rx415	JR	Notebook 93-04; pg. 11	

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
4/19/93	21:04	ACN	Spike STD	Rx415001.D012	Rx415	JR	Notebook 93-04; pg. 11	
4/21/93	10:26	Autocal 1	STD/25	Rx419001.D01	Rx419	TS	Supelco PAH Mix Lot No. LA 33993	
4/21/93	10:57	Autocal 2	STD/50	Rx419001.D02	Rx419	TS	Supelco PAH Mix Lot No. LA 33993	
4/21/93	11:28	Autocal 3	STD/100	Rx419001.D03	Rx419	TS	Supelco PAH Mix Lot No. LA 33993	
4/21/93	11:58	Rx 4/19/93	Reactor 4/19	Rx419001.D04	Rx419	TS	Notebook 93-04; pg. 10	
4/21/93	12:29	ACN		Rx419001.D05	Rx419	TS	Notebook 93-04; pg. 10	
4/26/93	14:41	Autocal 1	STD/25	Rx422001.D01	Rx422	JR	Supelco PAH Mix Lot No. LA 33993	
4/26/93	15:11	Autocal 2	STD/50	Rx422001.D02	Rx422	JR	Supelco PAH Mix Lot No. LA 33993	
4/26/93	15:42	Autocal 3	STD/100	Rx422001.D03	Rx422	JR	Supelco PAH Mix Lot No. LA 33993	
4/26/93	16:13	Rx A 4/22	Reactor 4/22/93	Rx422001.D04	Rx422	JR	Notebook 93-04; pg. 19	
4/26/93	16:43	Rx B 4/22		Rx422001.D05	Rx422	JR	Notebook 93-04; pg. 19	
4/26/93	17:14	Rx C 4/22		Rx422001.D06	Rx422	JR	Notebook 93-04; pg. 19	
4/26/93	17:45	ACN	Instrument blank	Rx422001.D07	Rx422	JR	Notebook 93-04; pg. 19	
4/28/93	12:25	Autocal 1	STD/25	Rx427001.D01		JR	Supelco PAH Mix 610 Lot No. LA 33993	
4/28/93	13:05	Autocal 2	STD/50	Rx427001.D01		JR	Supelco PAH Mix 610 Lot No. LA 33993	
4/28/93	13:36	Autocal 3	STD/100	Rx427001.D01		JR	Supelco PAH Mix 610 Lot No. LA 33993	
4/28/93	14:06	Rx 4/26		Rx427001.D01		JR	Notebook 93-04; pg. 29	

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
5/7/93	2:30	Autocal 1	STD/25	Rx540001.D01	Rx54	JR	Supelco PAH Mix Lot No. LA 33993	
5/7/93	2:30	Autocal 2	STD/50	Rx540001.D02	Rx54	JR	Supelco PAH Mix Lot No. LA 33993	
5/7/93	2:30	Autocal 3	STD/100	Rx540001.D03	Rx54	JR	Supelco PAH Mix Lot No. LA 33993	
5/7/93	2:30	Reactor 5/4/93		Rx540001.D04	Rx54	JR	Notebook 93-04; pg. 29	
5/7/93	2:30	Reactor 5/4/93		Rx540001.D05	Rx54	JR	Notebook 93-04; pg. 29	
5/7/93	2:30	Bottle Study 5/4/93		Rx540001.D06	Rx54	JR	Notebook 93-04; pg. 29	
5/11/93	11:45	Extract glass wood	Rx solvent rinse	Rx540001.D07	Rx54	TSS	QA check	
5/11/93	11:45	Extract nalgene	Rx solvent rinse	Rx540021.D06	Rx54	TSS	QA check	
5/12/93	11:18	Autocal 1	STD/25	Rx510001.D01	Rx56	TSS		
5/12/93	11:49	Autocal 2	STD/50	Rx510001.D02	Rx56	TSS		
5/12/93	12:20	Autocal 3	STD/100	Rx510001.D03	Rx56	TSS		
5/12/93	12:50	Final Rx A 5/6/93		Rx510001.D04	Rx56	TSS	Notebook 93-04; pg. 36	
5/12/93	13:21	Final Rx B 5/6/93		Rx510001.D05	Rx56	TSS	Notebook 93-04; pg. 36	
5/12/93	13:52	Final Rx C 5/6/93		Rx510001.D06	Rx56	TSS	Notebook 93-04; pg. 36	
5/12/93	14:25	Wash sludge A		Rx510001.D07	Rx56	TSS	Notebook 93-04; pg. 36	
5/12/93	14:55	Wash sludge B		Rx510001.D08	Rx56	TSS	Notebook 93-04; pg. 36	
5/12/93	16:40	Wash sludge C		Rx510001.D09	Rx56	TSS	Notebook 93-04; pg. 36	
5/12/93	17:11	Glass wool extract		Rx510001.D010	Rx56	TSS	Notebook 93-04; pg. 37	
5/12/93	17:41	Rx extract		Rx510001.D011	Rx56	TSS	Notebook 93-04; pg. 37	

Date Assayed	Time	Sample ID	Sample Description	File Name	Method Name	Operator	Comments	File Reference
5/20/93	20:47	Autocal 1	PAHCHK001.D01	3RD party check standard	PAHCHK	JR	Supelco PAH Mix 610 Lot No. LA 33993	
5/20/93	21:18	Autocal 2	PAHCHK001.D02	3RD party check standard	PAHCHK	JR	Supelco PAH Mix 610 Lot No. LA 33993	
5/20/93	21:49	Autocal 3	PAHCHK001.D03	3RD party check standard	PAHCHK	JR	Supelco PAH Mix 610 Lot No. LA 33993	
5/20/93	22:19	100 ng/ul ITAS PAH STD	PAHCHK001.D04	3RD party check standard	PAHCHK	JR	Notebook 93-04: pg 49	
5/20/93	22:50	80 ng/ul ITAS PAH STD, 3RD party check	PAHCHK001.D05	3RD party check standard	PAHCHK	JR	Notebook 93-04: pg 49	
5/20/93	23:21	50 ng/ul ITAS PAH STD, 3RD party check	PAHCHK001.D06	3RD party check standard	PAHCHK	JR	Notebook 93-04: pg 49	
5/20/93	23:51	25 ng/ul ITAS PAH STD, 3RD party check	PAHCHK001.D07	3RD party check standard	PAHCHK	JR	Notebook 93-04: pg 49	
5/21/93	00:22	1 ng/ul ITAS PAH STD, 3RD party check	PAHCHK001.D08	3RD party check standard	PAHCHK	JR	Notebook 93-04: pg 49	

C. Method Blanks

The frequency of method blank analysis is shown on the HPLC run log. These blanks were run with each sample batch as shown on the HPLC run log. The QC acceptance criteria for all blanks was non-detect. Results of the matrix blank analyses did not indicate the presence of any compounds. Preparation of samples was documented in the laboratory notebook.

D. Matrix Spike/Matrix Spike Duplicates

The frequency of matrix spikes analysis is shown on the HPLC run log. Spikes were run with each sample batch. QC acceptance criteria for recoveries was from 50 to 120 percent. Results of the analyses are included. Preparation of samples was documented in the laboratory notebook.

E. Laboratory Control Standards

The HPLC was calibrated prior to each sample batch analyzed. In addition, analysis of a third-party laboratory check standard was conducted.

Matrix Spike Recoveries and Laboratory Standards Check
Batch T_3 Sample 1 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	1,940[a]	1,950[b]	1,870	96
Chrysene	4,130	4,085	4,070	99
B(b)F	7,155	7,075	6,790	95
B(k)F	3,545	3,530	3,105	88
B(a)P	5,515	5,495	5,190	94
D(a,h)A	11,840	11,780	10,180	86
B(g,h,i)P	6,325	6,270	5,280	83
Indeno	2,980	2,955	2,770	93

[a] Measured concentration immediately following preparation. Concentrations were analyzed against a certified standard compared to a third-party laboratory check standard. Laboratory spike standards were manually prepared to increase concentrations substantially above background sample levels.

[b] Standard spike concentration determined prior to soil spike analysis.

Matrix Spike Recoveries and Laboratory Standards Check
Batch T_3 Sample 2 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	1,940[a]	1,995[b]	1,871	96
Chrysene	4,130	4,070	4,135	100
B(b)F	7,155	7,100	6,900	96
B(k)F	3,545	3,545	3,160	89
B(a)P	5,515	5,430	5,325	97
D(a,h)A	11,840	11,750	10,270	87
B(g,h,i)P	6,325	6,395	5,440	86
Indeno	2,980	2,975	2,790	94

[a] Measured concentration immediately following preparation. Concentrations were analyzed against a certified standard compared to a third-party laboratory check standard. Laboratory spike standards were manually prepared to increase concentrations substantially above background sample levels.

[b] Standard spike concentration determined prior to soil spike analysis.

Matrix Spike Recoveries and Laboratory Standards Check
Batch T_3 Sample 3 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	1,940[a]	1,875[b]	1,885	97
Chrysene	4,130	4,240	4,005	97
B(b)F	7,155	7,285	6,770	95
B(k)F	3,545	3,565	3,090	87
B(a)P	5,515	5,625	5,155	93
D(a,h)A	11,840	11,990	10,170	86
B(g,h,i)P	6,325	6,315	5,280	83
Indeno	2,980	3,005	2,760	93

[a] Measured concentration immediately following preparation. Concentrations were analyzed against a certified standard compared to a third-party laboratory check standard. Laboratory spike standards were manually prepared to increase concentrations substantially above background sample levels.

[b] Standard spike concentration determined prior to soil spike analysis.

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 3/8 Sample 1 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	1,940[a]	1,705[b]	1,765	91
Chrysene	4,130	4,195	4,290	104
B(b)F	7,155	7,075	7,445	104
B(k)F	3,545	3,235	3,330	94
B(a)P	5,515	4,710	4,890	89
D(a,h)A	11,840	10,430	10,355	87
B(g,h,i)P	6,325	5,230	5,275	83
Indeno	2,980	2,655	2,790	94

[a] Measured concentration immediately following preparation. Concentrations were analyzed against a certified standard compared to a third-party laboratory check standard. Laboratory spike standards were manually prepared to increase concentrations substantially above background sample levels.

[b] Standard spike concentration determined prior to soil spike analysis.

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 3/8 Sample 2 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	1,940[a]	1,735[b]	1,805	93
Chrysene	4,130	4,175	4,265	103
B(b)F	7,155	7,050	7,370	103
B(k)F	3,545	3,245	3,275	92
B(a)P	5,515	4,720	4,955	90
D(a,h)A	11,840	10,515	10,190	86
B(g,h,i)P	6,325	5,275	5,315	84
Indeno	2,980	2,665	2,770	93

[a] Measured concentration immediately following preparation. Concentrations were analyzed against a certified standard compared to a third-party laboratory check standard. Laboratory spike standards were manually prepared to increase concentrations substantially above background sample levels.

[b] Standard spike concentration determined prior to soil spike analysis.

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 3/8 Sample 3 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	1,940[a]	1,735[b]	1,810	93
Chrysene	4,130	4,180	4,375	106
B(b)F	7,155	7,055	7,520	105
B(k)F	3,545	3,245	3,380	95
B(a)P	5,515	4,675	5,035	91
D(a,h)A	11,840	10,670	10,405	88
B(g,h,i)P	6,325	5,320	5,390	85
Indeno	2,980	2,700	2,815	94

[a] Measured concentration immediately following preparation. Concentrations were analyzed against a certified standard compared to a third-party laboratory check standard. Laboratory spike standards were manually prepared to increase concentrations substantially above background sample levels.

[b] Standard spike concentration determined prior to soil spike analysis.

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 3/19 Sample 1 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	1,164[a]	951[b]	855	73
Chrysene	2,478	2,601	2,991	121
B(b)F	4,293	4,191	4,470	104
B(k)F	2,127	1,938	2,079	98
B(a)P	3,309	2,853	3,081	93
D(a,h)A	7,104	6,876	7,656	108
B(g,h,i)P	3,795	3,282	3,568	94
Indeno	1,788	1,650	1,873	105

[a] Measured concentration immediately following preparation. Concentrations were analyzed against a certified standard compared to a third-party laboratory check standard. Laboratory spike standards were manually prepared to increase concentrations substantially above background sample levels.

[b] Standard spike concentration determined prior to soil spike analysis.

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 3/19 Sample 2 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	1,164[a]	957[b]	861	74
Chrysene	2,478	2,544	2,976	120
B(b)F	4,293	4,203	4,515	105
B(k)F	2,127	1,935	2,106	99
B(a)P	3,309	2,856	3,111	94
D(a,h)A	7,104	6,933	7,710	109
B(g,h,i)P	3,795	3,189	3,592	95
Indeno	1,788	1,650	1,867	104

[a] Measured concentration immediately following preparation. Concentrations were analyzed against a certified standard compared to a third-party laboratory check standard. Laboratory spike standards were manually prepared to increase concentrations substantially above background sample levels.

[b] Standard spike concentration determined prior to soil spike analysis.

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 3/19 Sample 3 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	1,164[a]	960[b]	600	52
Chrysene	2,478	2,586	1,998	81
B(b)F	4,293	4,212	2,889	67
B(k)F	2,127	1,926	1,431	67
B(a)P	3,309	2,862	1,953	59
D(a,h)A	7,104	6,879	5,211	73
B(g,h,i)P	3,795	3,168	2,479	65
Indeno	1,788	1,662	1,303	73

[a] Measured concentration immediately following preparation. Concentrations were analyzed against a certified standard compared to a third-party laboratory check standard. Laboratory spike standards were manually prepared to increase concentrations substantially above background sample levels.

[b] Standard spike concentration determined prior to soil spike analysis.

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 4/1 Sample 1 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	3,600	3,433	3,008	84
Chrysene	3,600	3,533	2,777	77
B(b)F	3,600	3,243	2,425	67
B(k)F	3,600	3,483	2,896	80
B(a)P	3,600	3,453	3,150	88
D(a,h)A	3,600	3,433	2,853	79
B(g,h,i)P	3,600	3,543	2,984	83
Indeno	3,600	3,473	2,920	81

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 4/1 Sample 2 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	3,600	3,403	3,267	91
Chrysene	3,600	3,563	3,355	93
B(b)F	3,600	3,253	2,869	80
B(k)F	3,600	3,493	3,276	91
B(a)P	3,600	3,493	3,634	101
D(a,h)A	3,600	3,433	3,256	90
B(g,h,i)P	3,600	3,543	3,400	94
Indeno	3,600	3,483	3,305	92

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 4/1 Sample 3 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	3,600	3,313	2,918	81
Chrysene	3,600	3,703	2,653	74
B(b)F	3,600	3,263	2,387	66
B(k)F	3,600	3,493	2,803	78
B(a)P	3,600	3,403	3,013	84
D(a,h)A	3,600	3,533	2,817	78
B(g,h,i)P	3,600	3,493	2,929	81
Indeno	3,600	3,493	2,830	79

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 4/8 Sample 1 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	3,600	3,313	1,989	55
Chrysene	3,600	3,503	1,962	55
B(b)F	3,600	3,183	1,784	50
B(k)F	3,600	3,383	1,944	54
B(a)P	3,600	4,013	2,412	67
D(a,h)A	3,600	3,403	1,924	53
B(g,h,i)P	3,600	3,643	2,122	59
Indeno	3,600	3,393	1,978	55

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 4/8 Sample 2 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	3,600	3,353	3,100	86
Chrysene	3,600	3,453	3,145	87
B(b)F	3,600	3,173	2,983	83
B(k)F	3,600	3,373	3,109	86
B(a)P	3,600	3,933	4,039	112
D(a,h)A	3,600	3,423	3,082	86
B(g,h,i)P	3,600	3,623	3,424	95
Indeno	3,600	3,413	3,179	88

Matrix Spike Recoveries and Laboratory Standards Check
Reactor 4/8 Sample 3 of 3
Weston Batch and Bioslurry Investigations
IT Project No. 408491

Sample Identification	Standard Spike Concentration (ug)	Standard Spike Concentration Measured (ug)	Soil Spike Recoveries (ug)	Soil Spike Recoveries (%)
B(a)A	3,600	3,413	3,166	88
Chrysene	3,600	3,403	3,213	89
B(b)F	3,600	3,163	2,979	83
B(k)F	3,600	3,373	3,177	88
B(a)P	3,600	3,943	4,145	115
D(a,h)A	3,600	3,413	3,218	89
B(g,h,i)P	3,600	3,593	3,550	99
Indeno	3,600	3,413	3,244	90

Third-Party Laboratory Check Standard Results
IT Project No. 408491

Compounds	Concentration of Restek Standards				
	100 ug/ml	80 ug/ml	50 ug/ml	25 ug/ml	1 ug/ml
Naphthalene (ug/ml)	98.96	80.87	50.73	25.21	1.24
Acenaphthylene (ug/ml)	89.02	71.88	44.95	22.51	1.26
Acenaphthene (ug/ml)	77.48	76.94	41.19	19.95	2.76
Fluorene (ug/ml)	93.91	74.95	48.29	24.57	1.02
Phenanthrene (ug/ml)	90.58	73.78	47.53	24.46	1.03
Anthracene (ug/ml)	67.91	58.32	41.11	22.55	0.95
Fluoranthene (ug/ml)	91.24	74.54	47.69	24.31	1.04
Pyrene (ug/ml)	100.6	79.44	46.19	25.21	1.09
B(a)A (ug/ml)	87.34	72.21	46.48	23.73	1.00
Chrysene (ug/ml)	97.34	78.02	49.91	25.46	1.04
B(b)F (ug/ml)	91.34	73.93	47.26	24.10	0.98
B(k)F (ug/ml)	89.51	73.06	46.89	24.03	1.00
B(a)P (ug/ml)	105.0	83.67	52.23	25.69	0.94
D(a,h)A (ug/ml)	94.04	76.13	48.18	24.41	1.35
B(g,h,i)P (ug/ml)	100.7	81.86	50.97	25.56	1.03
Indeno(1,2,3-cd)pyrene (ug/ml)	95.06	76.76	48.89	24.98	1.10

Note: A 100-ug/ml Restek PAH standard was received from IT Analytical Services (ITAS). Serial dilutions of the stock standard were prepared by the BAC. The table illustrates the compound concentrations based on Supelco standards used for all BAC PAH analyses. A description of BAC calibration standards are provided in the project laboratory notebook, page 5, Book 93-04.

Third-Party Laboratory Check Standard Results
IT Project No. 408491

Compounds	Concentration of Restek Standards				
	100 ug/ml	80 ug/ml	50 ug/ml	25 ug/ml	1 ug/ml
Naphthalene (ug/ml)	98.96	80.87	50.73	25.21	1.24
Acenaphthylene (ug/ml)	89.02	71.88	44.95	22.51	1.26
Acenaphthene (ug/ml)	77.48	76.94	41.19	19.95	2.76
Fluorene (ug/ml)	93.91	74.95	48.29	24.57	1.02
Phenanthrene (ug/ml)	90.58	73.78	47.53	24.46	1.03
Anthracene (ug/ml)	67.91	58.32	41.11	22.55	0.95
Fluoranthene (ug/ml)	91.24	74.54	47.69	24.31	1.04
Pyrene (ug/ml)	100.6	79.44	46.19	25.21	1.09
B(a)A (ug/ml)	87.34	72.21	46.48	23.73	1.00
Chrysene (ug/ml)	97.34	78.02	49.91	25.46	1.04
B(b)F (ug/ml)	91.34	73.93	47.26	24.10	0.98
B(k)F (ug/ml)	89.51	73.06	46.89	24.03	1.00
B(a)P (ug/ml)	105.0	83.67	52.23	25.69	0.94
D(a,h)A (ug/ml)	94.04	76.13	48.18	24.41	1.35
B(g,h,i)P (ug/ml)	100.7	81.86	50.97	25.56	1.03
Indeno(1,2,3-cd)pyrene (ug/ml)	95.06	76.76	48.89	24.98	1.10

Note: A 100-ug/ml Restek PAH standard was received from IT Analytical Services (ITAS). Serial dilutions of the stock standard were prepared by the BAC. The table illustrates the compound concentrations based on Supelco standards used for all BAC PAH analyses. A description of BAC calibration standards are provided in the project laboratory notebook, page 5, Book 93-04.

F. Preparation Logs

Sample collection dates, locations, and collector identification were documented in the daily log section of the project-specific laboratory notebook. Copies of all laboratory notebook pages referring to the preparation of project samples, standards, blanks, and spikes were provided to Weston.

G. Calculations

Analyte concentrations were determined automatically by the HPLC. The basis of this determination was interpolation from linear regressed, three-point calibration (See example provided). Copies of all chromatograms and HPLC methods were supplied to Weston.

APPENDIX I
MASS BALANCE SPREADSHEET

WESTON BIOSLURRY REACTOR DATA

Weston
Project : 408491-003-20
rewes5-KJ 8/09/93
QC : LB

DATE 1993	REACTOR VOLUME V (L)	REACTOR SOLIDS CONC. X (gr/kg)	REACTOR DRY SOLID WEIGHT M (kg)	REACTOR SLURRY SAMPLE (L/day)	FEED FLOW Qo (L/day)	FEED SOLIDS CONC. Xo (gr/kg)	EFFLUENT FLOW Qe (L/day)	EFFLUENT SOLIDS CONC. Xe (gr/kg)	RECYCLE FLOW Qr (L/day)	RECYCLE SOLIDS CONC. Xr (mg/kg)	RECYCLE SLURRY SAMPLE (L/day)	BSRT M*7/5/(Me +Sra+Sr) (days)	HR V/Q *7/ (days
1/25	60	267	19.112	0.1	60	310	0.00						1.
1/26	56	299	20.383	0.4	0	310	0.00						
1/27	56	290	19.650	0.1	0	310	0.00						
1/28	54	309	21.408	0.1	8.60	310	2.70	285	0.8	314	0	32.8	8.
1/29	60	293	21.307	0.1	2.80	310	2.70	285	0.8	307	0	32.8	3
2/01	60	284	20.533	0.4	2.80	295	2.33	259	0.8	420	0.067	33.9	3
2/02	60	302	22.070	0	2.80	295	2.80	259	0.8	420	0	38.1	3
2/03	60	302	22.070	0	2.80	295	2.80	259	0.8	420	0	38.1	3
2/04	60	370	28.105	0.1	2.80	313	2.70	264	0.8	420	0	46.6	3
2/05	60	370	28.105	0	2.80	313	2.77	264	0.8	420	0.033	47.0	3
2/07	60	370	28.105	0	2.80	313	2.80	264	0.8	420	0	47.5	3
2/08	60	292	21.217	0.1	2.80	293	2.67	253	0.8	419	0.033	36.9	3
2/09	60	292	21.217	0.3	2.80	293	2.50	253	0.8	419	0	36.7	3
2/10	60	292	21.217	0	2.80	293	2.80	253	0.8	419	0	37.7	3
2/11	60	294	21.401	0.1	2.80	267	2.67	232	0.8	427	0.033	40.9	3
2/12	60	294	21.401	0	2.80	267	2.80	232	0.8	427	0	42.1	3
2/15	60	301	21.979	0.1	2.80	309	2.67	264	0.8	417	0.033	36.5	3
2/16	60	301	21.979	0.3	2.80	309	2.50	264	0.8	417	0	36.2	3
2/17	60	301	21.979	0	2.80	309	2.80	264	0.8	417	0	37.2	3
2/18	60	307	22.509	0.1	2.80	286	2.67	259	0.8	400	0.033	38.1	3
2/19	60	307	22.509	0	2.80	286	2.80	259	0.8	400	0	38.9	3
AVERAGE	60	310	22.7		3.1	298	2.7	260	0.8	406		38.8	28.
2/22	60	298	21.724	0.75	2.80	299	2.02	245	0.8	405	0.033	36.4	3
2/23	60	298	21.724	0	2.80	299	2.80	245	0.8	405	0	40.1	3
2/24	60	298	21.724	0	2.80	299	2.80	245	0.8	405	0	40.1	3
2/25	60	313	23.024	0.1	2.80	299	2.67	257	0.8	424	0.033	39.2	3
2/26	60	313	23.024	0	2.80	299	2.80	257	0.8	424	0	40.1	3
3/01	60	308	22.601	0.1	2.80	311	2.67	261	0.8	440	0.033	37.9	3
3/02	60	308	22.601	0.3	2.80	311	2.50	261	0.8	440	0	37.6	3
3/03	60	308	22.601	0	2.80	311	2.80	261	0.8	440	0	38.7	3
3/04	60	314	23.117	0.1	2.80	288	2.80	253	0.8	433	0	39.1	3
3/05	60	314	23.117	0	2.80	288	2.80	253	0.8	433	0	41.0	3
3/08	60	305	22.344	0.1	2.80	286	2.63	258	0.8	429	0.067	37.6	3
3/09	60	305	22.344	0.3	2.80	286	2.50	258	0.8	429	0	37.6	3
3/10	60	305	22.344	0	2.80	286	2.80	258	0.8	429	0	38.8	3
3/11	60	332	24.442	0.6	2.80	291	2.17	254	0.8	445	0.033	39.0	3
3/12	60	332	24.442	0	2.80	291	2.80	254	0.8	445	0	43.2	3
3/15	60	317	23.376	0.1	2.80	286	2.67	283	0.8	448	0.033	35.8	3
3/16	60	317	23.376	0.45	2.80	286	2.35	283	0.8	448	0	35.2	3
3/17	60	317	23.376	0	2.80	286	2.80	283	0.8	448	0	36.4	3
3/18	60	324	23.989	0.1	2.80	288	2.67	267	0.8	448	0.033	39.1	3
3/19	60	324	23.989	0	2.80	288	2.80	267	0.8	448	0	40.1	3
3/22	60	327	24.250	0.1	2.80	296	2.67	264	0.8	450	0.033	40.0	3
3/23	60	327	24.250	0.3	2.80	296	2.50	264	0.8	450	0	39.5	3
3/24	60	327	24.250	0	2.80	296	2.80	264	0.8	450	0	41.0	3
3/25	60	329	24.438	0.15	2.80	287	2.57	296	0.8	407	0.08	35.2	3
3/26	60	329	24.438	0	2.80	287	2.80	296	0.8	407	0	36.1	3
3/29	60	354	26.656	0.45	2.80	322	2.27	325	0.8	411	0.08	33.9	3
3/30	60	354	26.656	0	2.80	322	2.73	325	0.8	411	0	36.1	3
3/31	60	354	26.656	0	2.80	322	2.80	325	0.8	411	0	35.2	3
4/01	60	345	25.502	0.15	2.80	336	2.57	320	0.8	401	0.08	33.7	3
		BATCH SYSTEM											
4/01	60	345	25.502	0.15	2.80	336	2.57	320	0.8	401	0.08	33.7	3
4/02	59.85	334	24.807	0.14	0		0		0		0		
4/05	59.71	336	24.918	0.50	0		0		0		0		
4/08	59.21	328	24.024	0.39	0		0		0		0		
4/12	58.82	355	26.206	0.50	0		0		0		0		
4/15	58.32	335	24.265	0.245	0		0		0		0		
4/19	58.08	331	23.798	0.5	0		0		0		0		
4/22	57.58	340	24.371	0.5	0		0		0		0		
4/26	57.08	335	23.747	0.5	0		0		0		0		
4/29	56.58	339	23.878	0.5	0		0		0		0		
5/4	56.08	345	24.182	0.5	0		0		0		0		
5/6	58.84	363	25.632	0	0		0		0		0		

WESTON BIOSLURRY REACTOR DATA

Weston
Project : 408491
rewes5-KT- 8/09/93
QC : RB

DATE 1993	REACTOR DRY S M (kg)	EFFLUENT DRY S Me (kg/day)	REAC SP DRY S Sra (kg/day)	RECYC SP DRY S Sr (kg/day)	DRY SOLID REMAINED (DS1) M-Me-Sra-Sr (kg/day)	FEED DRY S Mo (kg/day)	DRY SOLID REMAINED DS1+Mo (kg/day)	ACTUAL FEED Dry solid (A) (kg/day)	LOSS DRY S A-M (kg/day)	% LOSS Dry S (A-M)/A (%)	EFF+SPL WASTED Me+Sra+Sr /A (%)	TOTAL LC Me+S +A- (%)
1/25	19.112	0	0.032	0	19.080	22.7478	19.080	22.748	3.636	16.0	0.1	1
1/26	20.383	0	0.146	0	20.238	0	20.238	19.080	-1.303	-6.8	0.8	-
1/27	19.650	0	0.035	0	19.615	0	19.615	20.238	0.587	2.9	0.2	[illegible]
1/28	21.408	0.874	0.040	0	20.494	3.261	23.755	19.615	-1.793	-9.1	4.7	[illegible]
1/29	21.307	0.874	0.036	0	20.397	1.062	21.459	23.755	2.448	10.3	3.8	1
2/01	20.533	0.674	0.137	0.037	19.686	1.004	20.690	21.459	0.926	4.3	4.0	[illegible]
2/02	22.070	0.810	0	0	21.260	1.004	22.265	20.690	-1.380	-6.7	3.9	[illegible]
2/03	22.070	0.810	0	0	21.260	1.004	22.265	22.265	0.194	0.9	3.6	4.5
2/04	28.105	0.798	0.047	0	27.260	1.074	28.334	22.265	-5.841	-26.2	3.8	-22.4
2/05	28.105	0.819	0	0.018	27.268	1.074	28.342	28.334	0.228	0.8	3.0	[illegible]
2/07	28.105	0.828	0	0	27.277	1.074	28.351	28.342	0.236	0.8	2.9	[illegible]
2/08	21.217	0.752	0.035	0.018	20.412	0.994	21.406	28.351	7.134	25.2	2.8	2
2/09	21.217	0.704	0.106	0	20.407	0.994	21.401	21.406	0.189	0.9	3.8	4.7
2/10	21.217	0.788	0	0	20.428	0.994	21.423	21.401	0.184	0.9	3.7	4.5
2/11	21.401	0.679	0.036	0.018	20.669	0.893	21.561	21.423	0.021	0.1	3.4	[illegible]
2/12	21.401	0.712	0	0	20.690	0.893	21.582	21.561	0.160	0.7	3.3	[illegible]
2/15	21.979	0.789	0.037	0.018	21.135	1.058	22.193	21.582	-0.397	-1.8	3.9	[illegible]
2/16	21.979	0.739	0.110	0	21.130	1.058	22.188	22.193	0.214	1.0	3.8	4.8
2/17	21.979	0.828	0	0	21.151	1.058	22.209	22.188	0.209	0.9	3.7	4.7
2/18	22.509	0.772	0.038	0.017	21.682	0.965	22.647	22.209	-0.300	-1.4	3.7	[illegible]
2/19	22.509	0.810	0	0	21.699	0.965	22.664	22.647	0.138	0.6	3.6	[illegible]
AVERAGE												
2/22	21.724	0.547	0.272	0.017	20.888	1.018	21.906	22.664	0.940	4.1	3.7	7
2/23	21.724	0.759	0	0	20.965	1.018	21.984	21.906	0.182	0.8	3.5	[illegible]
2/24	21.724	0.759	0	0	20.965	1.018	21.984	21.984	0.259	1.2	3.5	[illegible]
2/25	23.024	0.766	0.038	0.018	22.202	1.018	23.220	21.984	-1.041	-4.7	3.7	-1.[illegible]
2/26	23.024	0.803	0	0	22.221	1.018	23.239	23.220	0.196	0.8	3.5	4.3
3/01	22.601	0.779	0.038	0.019	21.765	1.066	22.831	23.239	0.638	2.7	3.6	6
3/02	22.601	0.729	0.113	0	21.759	1.066	22.824	22.831	0.230	1.0	3.7	4
3/03	22.601	0.817	0	0	21.784	1.066	22.850	22.824	0.223	1.0	3.6	4
3/04	23.117	0.788	0.039	0	22.290	0.974	23.264	22.850	-0.267	-1.2	3.6	2
3/05	23.117	0.788	0	0	22.328	0.974	23.302	23.264	0.147	0.6	3.4	4.0
3/08	22.344	0.757	0.037	0.038	21.512	0.965	22.477	23.302	0.958	4.1	3.6	7.7
3/09	22.344	0.720	0.112	0	21.513	0.965	22.478	22.477	0.133	0.6	3.7	4
3/10	22.344	0.806	0	0	21.538	0.965	22.503	22.478	0.133	0.6	3.6	4
3/11	24.442	0.613	0.244	0.019	23.565	0.984	24.549	22.503	-1.939	-8.6	3.9	-4
3/12	24.442	0.792	0	0	23.650	0.984	24.635	24.549	0.107	0.4	3.2	3.7
3/15	23.376	0.857	0.039	0.020	22.460	0.965	23.425	24.635	1.259	5.1	3.7	8.8
3/16	23.376	0.754	0.175	0	22.446	0.965	23.411	23.425	0.050	0.2	4.0	4
3/17	23.376	0.899	0	0	22.477	0.965	23.442	23.411	0.035	0.2	3.8	4
3/18	23.989	0.799	0.040	0.020	23.130	0.974	24.104	23.442	-0.547	-2.3	3.7	1
3/19	23.989	0.838	0	0	23.151	0.974	24.125	24.104	0.115	0.5	3.5	4.0
3/22	24.250	0.789	0.040	0.020	23.401	1.006	24.407	24.125	-0.125	-0.5	3.5	3.0
3/23	24.250	0.739	0.121	0	23.390	1.006	24.396	24.407	0.157	0.6	3.5	4
3/24	24.250	0.828	0	0	23.422	1.006	24.429	24.396	0.146	0.6	3.4	4
3/25	24.438	0.870	0.061	0.042	23.465	0.970	24.435	24.429	-0.010	-0.0	4.0	3
3/26	24.438	0.947	0	0	23.491	0.970	24.461	24.435	-0.003	-0.0	3.9	3
3/29	26.656	0.859	0.200	0.043	25.554	1.111	26.665	24.461	-2.195	-9.0	4.5	-4.5
3/30	26.656	1.034	0	0	25.623	1.111	26.733	26.665	0.009	0.0	3.9	3.9
3/31	26.656	1.060	0	0	25.596	1.111	26.707	26.733	0.077	0.3	4.0	4
4/01	25.502	0.956	0.064	0.041	24.442	1.168	25.610	26.707	1.204	4.5	4.0	8
	BATCH SYSTEM		kg		kg		kg	kg				M1-M1+SUM (Sra)/M1
4/01	25.502	0.956	0.064	0.041	24.442	1.168	25.610	26.707	1.204	4.5	4.0	8
4/02	24.807	0	0.058	0	24.749	0	24.749	25.610	0.803	3.1	0.2	3
4/05	24.918	0	0.209	0	24.709	0	24.709	24.749	-0.168	-0.7	0.8	2
4/08	24.024	0	0.158	0	23.865	0	23.865	24.709	0.685	2.8	0.6	7.2
4/12	26.206	0	0.223	0	25.983	0	25.983	23.865	-2.340	-9.8	0.9	-0.7
4/15	24.265	0	0.102	0	24.163	0	24.163	25.983	1.718	6.6	0.4	7
4/19	23.798	0	0.207	0	23.590	0	23.590	24.163	0.365	1.5	0.9	10
4/22	24.371	0	0.206	0	24.165	0	24.165	23.590	-0.781	-3.3	0.9	8
4/26	23.747	0	0.211	0	23.536	0	23.536	24.165	0.418	1.7	0.9	11.0
4/29	23.878	0	0.209	0	23.669	0	23.669	23.536	-0.342	-1.5	0.9	12.1
5/4	24.182	0	0.212	0	23.970	0	23.970	23.669	-0.513	-2.2	0.9	11
5/6	25.632	0	0.000	0	25.632	0	25.632	23.970	-1.662	-6.9	0.0	6

WESTON BIOSLURRY REACTOR DATA

Weston
Project : 408491
rewes5-KI- 8/09/93
QC :

MASS BALANCE OF 3.6 L, RECYCLE AND EFFLUENT

DATE 1993	REACTOR SLURRY Rslt (3.6L/day) 3.6 (kg/day)	DRY SOLID (3.6L/day) MS1 (kg/day)	RECYCLE SLURRY SAMPLE Src (kg/day)	RECYCLE SAMPLE Dry S Sr (kg/day)	SLURRY (Sout) Qrt+Qet+ +Src+Sra (kg/day)	SLURRY (Wet) Rslt /Sout	DRY SOLID (Mout) Mr+Me+ +Sr+Sra (kg/day)	DRY SOLID MS1/Mout
1/25								
1/26								
1/27								
1/28	4.619	1.427	0	0	4.177	1.11	1.222	1.17
1/29	4.363	1.278	0	0	4.166	1.05	1.210	1.06
2/01	4.338	1.232	0.087	0.037	4.214	1.03	1.285	0.96
2/02	4.385	1.324	0	0	4.170	1.05	1.248	1.06
2/03	4.385	1.324	0	0	4.170	1.05	1.248	1.06
2/04	4.558	1.686	0	0	4.193	1.09	1.283	1.31
2/05	4.558	1.686	0.043	0.018	4.188	1.09	1.275	1.32
2/07	4.558	1.686	0	0	4.178	1.09	1.266	1.33
2/08	4.360	1.273	0.043	0.018	4.177	1.04	1.241	1.03
2/09	4.360	1.273	0	0	4.187	1.04	1.246	1.02
2/10	4.360	1.273	0	0	4.157	1.05	1.225	1.04
2/11	4.363	1.284	0.043	0.018	4.136	1.05	1.179	1.09
2/12	4.363	1.284	0	0	4.114	1.06	1.158	1.11
2/15	4.381	1.319	0.043	0.018	4.195	1.04	1.278	1.03
2/16	4.381	1.319	0	0	4.205	1.04	1.283	1.03
2/17	4.381	1.319	0	0	4.176	1.05	1.262	1.05
2/18	4.399	1.351	0.043	0.017	4.177	1.05	1.239	1.09
2/19	4.399	1.351	0	0	4.158	1.06	1.222	1.11
AVERAGE								
2/22	4.374	1.303	0.043	0.017	4.221	1.04	1.254	1.04
2/23	4.374	1.303	0	0	4.130	1.06	1.177	1.11
2/24	4.374	1.303	0	0	4.130	1.06	1.177	1.11
2/25	4.414	1.381	0.043	0.018	4.189	1.05	1.265	1.09
2/26	4.414	1.381	0	0	4.169	1.06	1.246	1.11
3/01	4.403	1.356	0.043	0.019	4.204	1.05	1.299	1.04
3/02	4.403	1.356	0	0	4.215	1.04	1.306	1.04
3/03	4.403	1.356	0	0	4.183	1.05	1.280	1.06
3/04	4.417	1.387	0	0	4.285	1.03	1.280	1.08
3/05	4.417	1.387	0	0	4.162	1.06	1.241	1.12
3/08	4.396	1.341	0.088	0.038	4.192	1.05	1.281	1.05
3/09	4.396	1.341	0	0	4.204	1.05	1.281	1.05
3/10	4.396	1.341	0	0	4.172	1.05	1.255	1.07
3/11	4.417	1.467	0.044	0.019	4.251	1.04	1.347	1.09
3/12	4.417	1.467	0	0	4.172	1.06	1.261	1.16
3/15	4.424	1.403	0.044	0.020	4.252	1.04	1.389	1.01
3/16	4.424	1.403	0	0	4.276	1.03	1.403	1.00
3/17	4.424	1.403	0	0	4.233	1.05	1.372	1.02
3/18	4.442	1.439	0.044	0.020	4.218	1.05	1.332	1.08
3/19	4.442	1.439	0	0	4.196	1.06	1.312	1.10
3/22	4.450	1.455	0.044	0.020	4.216	1.06	1.326	1.10
3/23	4.450	1.455	0	0	4.229	1.05	1.337	1.09
3/24	4.450	1.455	0	0	4.194	1.06	1.304	1.12
3/25	4.457	1.466	0.103	0.042	4.260	1.05	1.393	1.05
3/26	4.457	1.466	0	0	4.234	1.05	1.368	1.07
3/29	4.518	1.599	0.104	0.043	4.349	1.04	1.528	1.05
3/30	4.518	1.599	0	0	4.216	1.07	1.459	1.10
3/31	4.518	1.599	0	0	4.298	1.05	1.486	1.08
4/01	4.435	1.530	0.103	0.041	4.305	1.03	1.474	1.04
	BATCH SYSTEM							
4/01	4.435	1.530	0.103	0.041	4.305	1.03	1.474	1.04
4/02	0	0	0	0	0.174		0.058	
4/05	0	0	0	0	0.621		0.209	
4/08	0	0	0	0	0.482		0.158	
4/12	0	0	0	0	0.628		0.223	
4/15	0	0	0	0	0.304		0.102	
4/19	0	0	0	0	0.619		0.207	
4/22	0	0	0	0	0.623		0.206	
4/26	0	0	0	0	0.621		0.211	
4/29	0	0	0	0	0.623		0.209	
5/4	0	0	0	0	0.625		0.212	
5/6	0	0	0	0	0.000		0.000	

WESTON BIOSLURRY REACTOR DATA

Weston Project. -08
westo5 8/
QC :

DATE 1993	MASS BALANCE OF ORGANICS IN INFLUENT: Ti Air dry (mg/kgAD)	Ti Oven dry 0.9684 (mg/kgOD)	Tin Ti*Ho (gr/day)	Ti.CPAH Air dry (mg/kgAD)	Ti.CPAH Oven dry 0.9684 (mg/kgOD	Tin CPAH (gr/day)	MASS BALANCE OF ORGANICS IN REACTOR: T Air dry (mg/kgAD)	T Oven dry 0.9634 (mg/kgOD)	Tx T*N (gr)	T.CPAH Air dry (mg/kgAD)	T.CPAH Oven dry 0.9634 (mg/kgOD	Tx CPAH (gr)	FEED/REACTOR %(mg/kg) TOTAL (Ti-T) /Ti	% CPA Ti /T
1/25	1,000	1,033	23.49	300.0	309.8	7.05	1,000	1,033	19.74	300.0	309.8	5.92	0.0	
1/26			0			0			21.05			6.31		
1/27			0			0	450	467.1	20.29	240.0	249.1	6.09	54.8	1
1/28														
1/29			1.10			0.33			22.00			6.60		
2/01	900.0	929.4	0.93	270.0	278.8	0.28	320.0	332.2	6.82	210.0	218.0	4.48	64.3	21
2/02														
2/03			0.93			0.28			7.33			4.81		
2/04	890.0	919.0	0.99	260.0	268.5	0.29	280.0	290.6	8.17	180.0	186.8	5.25	68.4	30
2/05														
2/07			0.99			0.29			8.17			5.25		
2/08	990.0	1022.3	1.02	280.0	289.1	0.29	280.0	290.6	6.17	170.0	176.5	3.74	71.6	39
2/09														
2/10			1.02			0.29			6.17			3.74		
2/11	910.0	939.7	0.84	260.0	268.5	0.24	220.0	228.4	4.89	120.0	124.6	2.67	75.7	53.
2/12			0.84			0.24			4.89			2.67		
2/15	1,000	1032.6	1.09	270.0	278.8	0.30	310.0	321.8	7.07	180.0	186.8	4.11	68.8	33
2/16														
2/17			1.09			0.30			7.07			4.11		
2/18	1,100	1135.9	1.10	230.0	237.5	0.23	370.0	384.1	8.64	160.0	166.1	3.74	66.2	30.
2/19			1.10			0.23			8.64			3.74		
AVERAGE														
2/22	1,000	1032.6	1.05	270.0	278.8	0.28	430.0	446.3	9.70	180.0	186.8	4.06	56.8	33.
2/23														
2/24			1.05			0.28			9.70			4.06		
2/25	720	743.5	0.76	220.0	227.2	0.23	500.0	519.0	11.95	180.0	186.8	4.30	30.2	17.
2/26			0.76			0.23			11.95			4.30		
3/01	1,100	1135.9	1.21	220.0	227.2	0.24	580.0	602.0	13.61	190.0	197.2	4.46	47.0	13.
3/02														
3/03			1.21			0.24			13.61			4.46		
3/04	1,100	1135.9	1.11	200.0	206.5	0.20	600.0	622.8	14.40	170.0	176.5	4.08	45.2	14.
3/05			1.11			0.20			14.40			4.08		
3/08	1,090	1125.6	1.09	300.0	309.8	0.30	620.0	643.6	14.38	200.0	207.6	4.64	42.8	33.
3/09														
3/10			1.09			0.30			14.38			4.64		
3/11	910	939.7	0.92	210.0	216.9	0.21	530.0	550.1	13.45	160.0	166.1	4.06	41.5	13.
3/12			0.92			0.21			13.45			4.06		
3/15	1,000	1032.6	1.00	230.0	237.5	0.23	660.0	685.1	16.01	190.0	197.2	4.61	33.7	17.
3/16														
3/17			1.00			0.23			16.01			4.61		
3/18	1,100	1135.9	1.11	260.0	268.5	0.26	750.0	778.5	18.68	230.0	238.7	5.73	31.5	1.
3/19			1.11			0.26			18.68			5.73		
3/22	1,200	1239.2	1.25	290.0	299.5	0.30	740.0	768.1	18.63	190.0	197.2	4.78	38.0	34.
3/23														
3/24			1.25			0.30			18.63			4.78		
3/25	1,100	1135.9	1.10	210.0	216.9	0.21	820.0	851.2	20.80	170.0	176.5	4.31	25.1	8.
3/26			1.10			0.21			20.80			4.31		
3/29	1,100	1135.9	1.26	240.0	247.8	0.28	810.0	840.8	22.41	210.0	218.0	5.81	26.0	12.
3/30														
3/31			1.26			0.28			22.41			5.81		
4/01	790	815.8	0.95	250.0	258.2	0.30	860.0	884.9	22.57	280.0	288.1	7.35	-8.5	1.
	BATCH SYSTEM						Moist vari			Moist vari			(T1-Ti), %	%
4/01	790.0	815.8	0.95	250.0	258.2	0.30	860.0	884.9	22.57	280.0	288.1	7.35	0.0	0.
4/02		0	0		0	0	840.0	856.3	21.24	260.0	265.0	6.57	3.2	8.
4/05		0	0		0	0	670.0	686.4	17.10	270.0	276.6	6.89	22.4	4.
4/08		0	0		0	0	570.0	589.5	14.16	220.0	227.5	5.47	33.4	1.
4/12		0	0		0	0	610.0	643.7	16.87	160.0	168.8	4.42	27.3	41.
4/15		0	0		0	0	750.0	791.4	19.20	190.0	200.5	4.86	30.6	30.
4/19		0	0		0	0	740.0	786.8	18.72	160.0	170.1	4.05	31.1	0.
4/22		0	0		0	0	810.0	861.2	20.99	220.0	233.9	5.70	2.7	8.
4/26		0	0		0	0	820.0	864.0	20.52	210.0	221.3	5.25	2.4	3.
4/29		0	0		0	0	700.0	737.5	17.61	170.0	179.1	4.28	16.6	37.
5/4		0	0		0	0	670.0	706.4	17.08	170.0	179.2	4.33	22.2	37.
5/6		0	0		0	0	560.0	587.4	15.06	170.0	178.3	4.57	33.6	38.

WESTON BIOSLURRY REACTOR DATA

Weston
Project : 408491-003-20
rewes5-KT- 8/09/93
QC : KB

MASS BALANCE OF ORGANICS IN REACTOR

DATE 1993	T Air dry (mg/kgAD)	T Oven dry 0.9634 (mg/kgOD)	Tx T*M (gr)	T.CPAH Air dry (mg/kgAD)	T.CPAH Oven dry 0.9634 (mg/kgOD	Tx CPAH (gr)	FEED/REACTOR %(mg/kg) TOTAL (Ti-T) /Ti	% CPAH (Ti-T) /Ti	Te T*Me (gr/day)	Te CPAH (gr/day)	q Q(So-Se)/VX mg PAH/gr TSS TOTAL	CPAH
1/25	1,000	1,033	19.74	300.0	309.8	5.92	0.0	0.0	0.00	0.00	1.229	0.369
1/26			21.05			6.31						
1/27	450	467.1	20.29	240.0	249.1	6.09	54.8	19.6	0.00	0.00		
1/28												
1/29			22.00			6.60			0.90	0.27	0.009	0.003
2/01	320.0	332.2	6.82	210.0	218.0	4.48	64.3	21.8	0.22	0.15	0.035	0.006
2/02												
2/03			7.33			4.81			0.27	0.18	0.030	0.005
2/04	280.0	290.6	8.17	180.0	186.8	5.25	68.4	30.4	0.23	0.15	0.027	0.005
2/05												
2/07			8.17			5.25			0.24	0.15	0.027	0.005
2/08	280.0	290.6	6.17	170.0	176.5	3.74	71.6	39.0	0.22	0.13	0.038	0.007
2/09												
2/10			6.17			3.74			0.23	0.14	0.037	0.007
2/11	220.0	228.4	4.89	120.0	124.6	2.67	75.7	53.6	0.16	0.08	0.032	0.007
2/12			4.89			2.67			0.16	0.09	0.032	0.007
2/15	310.0	321.8	7.07	180.0	186.8	4.11	68.8	33.0	0.25	0.15	0.038	0.007
2/16												
2/17			7.07			4.11						
2/18	370.0	384.1	8.64	160.0	166.1	3.74	66.2	30.1	0.30	0.13	0.036	0.004
2/19			8.64			3.74						
AVERAGE									AVERAGED VALUE:		0.031	0.006
2/22	430.0	446.3	9.70	180.0	186.8	4.06	56.8	33.0	0.24	0.10	0.037	0.008
2/23												
2/24			9.70			4.06						
2/25	500.0	519.0	11.95	180.0	186.8	4.30	30.2	17.8	0.40	0.14	0.016	0.004
2/26			11.95			4.30						
3/01	580.0	602.0	13.61	190.0	197.2	4.46	47.0	13.2	0.47	0.15	0.033	0.004
3/02												
3/03			13.61			4.46						
3/04	600.0	622.8	14.40	170.0	176.5	4.08	45.2	14.6	0.49	0.14	0.027	0.003
3/05			14.40			4.08						
3/08	620.0	643.6	14.38	200.0	207.6	4.64	42.8	33.0	0.49	0.16	0.027	0.006
3/09												
3/10			14.38			4.64						
3/11	530.0	550.1	13.45	160.0	166.1	4.06	41.5	23.4	0.34	0.10	0.024	0.005
3/12			13.45			4.06						
3/15	660.0	685.1	16.01	190.0	197.2	4.61	33.7	17.0	0.59	0.17	0.018	0.003
3/16												
3/17			16.01			4.61						
3/18	750.0	778.5	18.68	230.0	238.7	5.73	31.5	11.1	0.62	0.19	0.020	0.003
3/19			18.68			5.73						
3/22	740.0	768.1	18.63	190.0	197.2	4.78	38.0	34.1	0.61	0.16	0.026	0.006
3/23												
3/24			18.63			4.78						
3/25	820.0	851.2	20.80	170.0	176.5	4.31	25.1	18.6	0.74	0.15	0.015	0.002
3/26			20.80			4.31						
3/29	810.0	840.8	22.41	210.0	218.0	5.81	26.0	12.0	0.72	0.19	0.020	0.003
3/30												
3/31			22.41			5.81						
4/01	860.0	884.9	22.57	280.0	288.1	7.35	-8.5	-11.6	0.85	0.28	0.004	0.001
		Moist vari			Moist vari		(T1-Ti)/T1 %	%	AVERAGED VALUE: (for 12 data)		0.022	0.004
4/01	860.0	884.9	22.57	280.0	288.1	7.35	0.0	0.0			0	0
4/02	840.0	856.3	21.24	260.0	265.0	6.57	3.2	8.0			0.052	0.030
4/05	670.0	686.4	17.10	270.0	276.6	6.89	22.4	4.0			0.055	0.005
4/08	570.0	589.5	14.16	220.0	227.5	5.47	33.4	21.0			0.049	0.011
4/12	610.0	643.7	16.87	160.0	168.8	4.42	27.3	41.4			0.022	0.011
4/15	750.0	791.4	19.20	190.0	200.5	4.86	10.6	30.4			0.009	0.007
4/19	740.0	786.8	18.72	160.0	170.1	4.05	11.1	40.9			0.009	0.008
4/22	810.0	861.2	20.99	220.0	233.9	5.70	2.7	18.8			0.003	0.003
4/26	820.0	864.0	20.52	210.0	221.3	5.25	2.4	23.2			0.003	0.003
4/29	700.0	737.5	17.61	170.0	179.1	4.28	16.6	37.8			0.008	0.005
5/4	670.0	706.4	17.08	170.0	179.2	4.33	20.2	37.8			0.007	0.004
5/6	560.0	587.4	15.06	170.0	178.3	4.57	33.6	38.1				
									AVERAGED VALUE:		0.022	0.009

WESTON BIOSLURRY REACTOR DATA

Weston
Project : 408491-003-20
rewes5-KT- 8/09/93
QC : kB

MASS BALANCE OF ORGANICS IN REACTOR

DATE 1993	T Air dry (mg/kgAD)	T Oven dry 0.9634 (mg/kgOD)	Tx T*M (gr)	T.CPAH Air dry (mg/kgAD)	T.CPAH Oven dry 0.9634 (mg/kgOD)	Tx CPAH (gr)	FEED/REACTOR %(mg/kg) TOTAL (Ti-T) /Ti	FEED/REACTOR % CPAH (Ti-T) /Ti	Te T*Me (gr/day)	Te CPAH (gr/day)	q Q(So-Se)/VX mg PAH/gr TSS TOTAL	q Q(So-Se)/VX mg PAH/gr TSS CPAH
1/25	1,000	1,033	19.74	300.0	309.8	5.92	0.0	0.0	0.00	0.00	1.229	0.369
1/26			21.05			6.31						
1/27	450	467.1	20.29	240.0	249.1	6.09	54.8	19.6	0.00	0.00		
1/28												
1/29			22.00			6.60			0.90	0.27	0.009	0.003
2/01	320.0	332.2	6.82	210.0	218.0	4.48	64.3	21.8	0.22	0.15	0.035	0.006
2/02												
2/03			7.33			4.81			0.27	0.18	0.030	0.005
2/04	280.0	290.6	8.17	180.0	186.8	5.25	68.4	30.4	0.23	0.15	0.027	0.005
2/05												
2/07			8.17			5.25			0.24	0.15	0.027	0.005
2/08	280.0	290.6	6.17	170.0	176.5	3.74	71.6	39.0	0.22	0.13	0.038	0.007
2/09												
2/10			6.17			3.74			0.23	0.14	0.037	0.007
2/11	220.0	228.4	4.89	120.0	124.6	2.67	75.7	53.6	0.16	0.08	0.032	0.007
2/12			4.89			2.67			0.16	0.09	0.032	0.007
2/15	310.0	321.8	7.07	180.0	186.8	4.11	68.8	33.0	0.25	0.15	0.038	0.007
2/16												
2/17			7.07			4.11						
2/18	370.0	384.1	8.64	160.0	166.1	3.74	66.2	30.1	0.30	0.13	0.036	0.004
2/19			8.64			3.74						
AVERAGE												
2/22	430.0	446.3	9.70	180.0	186.8	4.06	56.8	33.0	0.24	0.10	0.037	0.008
2/23												
2/24			9.70			4.06						
2/25	500.0	519.0	11.95	180.0	186.8	4.30	30.2	17.8	0.40	0.14	0.016	0.004
2/26			11.95			4.30						
3/01	580.0	602.0	13.61	190.0	197.2	4.46	47.0	13.2	0.47	0.15	0.033	0.004
3/02												
3/03			13.61			4.46						
3/04	600.0	622.8	14.40	170.0	176.5	4.08	45.2	14.6	0.49	0.14	0.027	0.003
3/05			14.40			4.08						
3/08	620.0	643.6	14.38	200.0	207.6	4.64	42.8	33.0	0.49	0.16	0.027	0.006
3/09												
3/10			14.38			4.64						
3/11	530.0	550.1	13.45	160.0	166.1	4.06	41.5	23.4	0.34	0.10	0.024	0.005
3/12			13.45			4.06						
3/15	660.0	685.1	16.01	190.0	197.2	4.61	33.7	17.0	0.59	0.17	0.018	0.003
3/16												
3/17			16.01			4.61						
3/18	750.0	778.5	18.68	230.0	238.7	5.73	31.5	11.1	0.62	0.19	0.020	0.003
3/19			18.68			5.73						
3/22	740.0	768.1	18.63	190.0	197.2	4.78	38.0	34.1	0.61	0.16	0.026	0.006
3/23												
3/24			18.63			4.78						
3/25	820.0	851.2	20.80	170.0	176.5	4.31	25.1	18.6	0.74	0.15	0.015	0.002
3/26			20.80			4.31						
3/29	810.0	840.8	22.41	210.0	218.0	5.81	26.0	12.0	0.72	0.19	0.020	0.003
3/30												
3/31			22.41			5.81						
4/01	860.0	884.9	22.57	280.0	288.1	7.35	-8.5	-11.6	0.85	0.28	0.004	0.001
		Moist vari			Moist vari		(Ti-Ti)/Ti %	(Ti-Ti)/Ti %	AVERAGED VALUE: (for 23 data)		0.026	0.005
4/01	860.0	884.9	22.57	280.0	288.1	7.35	0.0	0.0			0	0
4/02	840.0	856.3	21.24	260.0	265.0	6.57	3.2	8.0			0.052	0.030
4/05	670.0	686.4	17.10	270.0	276.6	6.89	22.4	4.0			0.055	0.005
4/08	570.0	589.5	14.16	220.0	227.5	5.47	33.4	21.0			0.049	0.011
4/12	610.0	643.7	16.87	160.0	168.8	4.42	27.3	41.4			0.022	0.011
4/15	750.0	791.4	19.20	190.0	200.5	4.86	10.6	30.4			0.009	0.007
4/19	740.0	786.8	18.72	160.0	170.1	4.05	11.1	40.9			0.009	0.008
4/22	810.0	861.2	20.99	220.0	233.9	5.70	2.7	18.8			0.003	0.003
4/26	820.0	864.0	20.52	210.0	221.3	5.25	2.4	23.2			0.003	0.003
4/29	700.0	737.5	17.61	170.0	179.1	4.28	16.6	37.8			0.008	0.005
5/4	670.0	706.4	17.08	170.0	179.2	4.33	20.2	37.8			0.007	0.004
5/6	560.0	587.4	15.06	170.0	178.3	4.57	33.6	38.1				
									AVERAGED VALUE:		0.022	0.009

WESTON BIOSLURRY REACTOR DATA

Weston
Project : 408491-003-20
rewes5-KT- 8/09/93
QC : KD

MASS BALANCE OF TOTAL PAH

DATE 1993	FEED Tin (gr/day)	REACTOR Tx (gr)	Tx+Tin -MS1C+Trc REMAINED (gr/day)	ACTUAL FEED IN REACTOR (Ao) (gr)	T ORGAN. LOSS Ao-Tx (gr)	% LOSS (Ao-Tx)/Ao (%)
1/25	23.49	19.74	19.74	23.49	3.75	16.0
1/26	0	21.05	21.05	19.74	-1.31	-6.7
1/27						
1/28						
1/29	1.10	22.00	21.95			
2/01	0.93	6.82	7.49	21.95	15.13	68.9
2/02						
2/03	0.93	7.33	7.97			
2/04	0.99	8.17	8.81	7.97	-0.20	-2.5
2/05						
2/07	0.99	8.17	8.81			
2/08	1.02	6.17	6.94	8.81	2.65	30.0
2/09						
2/10	1.02	6.17	6.94			
2/11	0.84	4.89	5.56	6.94	2.05	29.5
2/12	0.84	4.89	5.56	5.56	0.67	12.1
2/15	1.09	7.07	7.87	5.56	-1.51	-27.2
2/16						
2/17	1.09	7.07	7.87			
2/18	1.10	8.64	9.35	7.87	-0.77	-9.8
2/19	1.10	8.64	9.35	9.35	0.70	7.5
AVERAGE						
2/22	1.05	9.70	10.35	9.35	-0.35	-3.7
2/23						
2/24	1.05	9.70	10.35			
2/25	0.76	11.95	12.19	10.35	-1.60	-15.4
2/26	0.76	11.95	12.19	12.19	0.24	1.9
3/01	1.21	13.61	14.28	12.19	-1.42	-11.6
3/02						
3/03	1.21	13.61	14.28			
3/04	1.11	14.40	14.91	14.28	-0.12	-0.8
3/05	1.11	14.40	14.91	14.91	0.52	3.5
3/08	1.09	14.38	14.89	14.91	0.53	3.6
3/09						
3/10	1.09	14.38	14.89			
3/11	0.92	13.45	13.87	14.89	1.45	9.7
3/12	0.92	13.45	13.87	13.87	0.42	3.0
3/15	1.00	16.01	16.38	13.87	-2.15	-15.5
3/16						
3/17	1.00	16.01	16.38			
3/18	1.11	18.68	19.04	16.38	-2.29	-14.0
3/19	1.11	18.68	19.04	19.04	0.36	1.9
3/22	1.25	18.63	19.13	19.04	0.41	2.2
3/23						
3/24	1.25	18.63	19.13			
3/25	1.10	20.80	21.00	19.13	-1.67	-8.7
3/26	1.10	20.80	21.00	21.00	0.20	0.9
3/29	1.26	22.41	22.69	21.00	-1.41	-6.7
3/30						
3/31	1.26	22.41	22.69			
4/01	0.95	22.57	22.52	22.69	0.12	0.6

		Tx	Txs Tx+TSra			% REMOVAL Txs1-Txsi.
4/01	0.95	22.57	22.52	22.69	0.12	0.6
4/02	0	21.24	21.24	22.52		5.7
4/05	0	17.10	17.15			23.8
4/08	0	14.16	14.35			36.3
4/12	0	16.87	17.15			23.8
4/15	0	19.20	19.63			12.8
4/19	0	18.72	19.23			14.6
4/22	0	20.99	21.66			3.8
4/26	0	20.52	21.37			5.1
4/29	0	17.61	18.64			17.2
5/4	0	17.08	18.27			18.9
5/6	0	15.06	16.39			27.2

MASS BALANCE OF CPAH

FEED Ti.CPAH (gr/day)	REACTOR Tx.CPAH (gr)	CPAH Tx+Ti -S1+Trc REMAINED (gr/day)	ACTUAL FEED IN REACTOR (A1) (gr)	T CPAH LOSS A1-Tx (gr)	% LOSS (A1-Tx)/A (%)
7.05	5.92	12.97	7.05	1.13	15.98
0	6.31	6.31	12.97	6.65	51.31
0.33	6.60	6.62			
0.28	4.48	4.58	6.62	2.15	32.41
0.28	4.81	4.90			
0.29	5.25	5.32	4.90	-0.35	-7.22
0.29	5.25	5.32			
0.29	3.74	3.88	5.32	1.58	29.62
0.29	3.74	3.88			
0.24	2.67	2.82	3.88	1.22	31.31
0.24	2.67	2.82	2.82	0.16	5.52
0.30	4.11	4.23	2.82	-1.28	-45.54
0.30	4.11	4.23			
0.23	3.74	3.82	4.23	0.49	11.67
0.23	3.74	3.82	3.82	0.08	2.04
0.28	4.06	4.17	3.82	-0.24	-6.36
0.28	4.06	4.17			
0.23	4.30	4.35	4.17	-0.13	-3.05
0.23	4.30	4.35	4.35	0.05	1.21
0.24	4.46	4.52	4.35	-0.10	-2.36
0.24	4.46	4.52			
0.20	4.08	4.12	4.52	0.44	9.73
0.20	4.08	4.12	4.12	0.04	1.00
0.30	4.64	4.75	4.12	-0.52	-12.58
0.30	4.64	4.75			
0.21	4.06	4.13	4.75	0.69	14.62
0.21	4.06	4.13	4.13	0.07	1.68
0.23	4.61	4.66	4.13	-0.48	-11.67
0.23	4.61	4.66			
0.26	5.73	5.76	4.66	-1.07	-22.94
0.26	5.73	5.76	5.76	0.03	0.52
0.30	4.78	4.91	5.76	0.97	16.93
0.30	4.78	4.91			
0.21	4.31	4.34	4.91	0.60	12.17
0.21	4.31	4.34	4.34	0.03	0.65
0.28	5.81	5.83	4.34	-1.47	-33.87
0.28	5.81	5.83			
0.30	7.35	7.30	5.83	-1.52	-26.01

	Tx	Txs Tx+TSra			% REMOVAL Txs1-Txs..
0.30	7.35	7.30	5.83	-1.52	-26.01
	6.57	6.57	7.30		9.9
	6.89	6.91			5.4
	5.47	5.54			24.1
	4.42	4.53			37.9
	4.86	5.01			31.3
	4.05	4.22			42.2
	5.70	5.90			19.1
	5.25	5.50			24.6
	4.28	4.57			37.3
	4.33	4.67			36.0
	4.57	4.94			32.3

WESTON BIOSLURRY REACTOR DATA

Weston
Project : 408491-003-20
rewes5-KT- 8/09/93
QC : KD

MASS BALANCE OF TOTAL PAH

DATE 1993	FEED Tin (gr/day)	REACTOR Tx (gr)	Tx+Tin -MS1C+Trc REMAINED (gr/day)	ACTUAL FEED IN REACTOR (Ao) (gr)	T ORGAN LOSS Ao-Tx (gr)	T ORGAN. REMOVAL Ao-Tx (gr/day)
1/25	23.49	19.74	19.74	23.49	3.75	
1/26	0	21.05	21.05	19.74	-1.31	
1/27						
1/28						
1/29	1.10	22.00	21.95			
2/01	0.93	6.82	7.49	21.95	15.13	15.13
2/02						
2/03	0.93	7.33	7.97			
2/04	0.99	8.17	8.81	7.97	-0.20	0.00
2/05						
2/07	0.99	8.17	8.81			
2/08	1.02	6.17	6.94	8.81	2.65	2.65
2/09						
2/10	1.02	6.17	6.94			
2/11	0.84	4.89	5.56	6.94	2.05	2.05
2/12	0.84	4.89	5.56	5.56	0.67	0.67
2/15	1.09	7.07	7.87	5.56	-1.51	0.00
2/16						
2/17	1.09	7.07	7.87			
2/18	1.10	8.64	9.35	7.87	-0.77	0.00
2/19	1.10	8.64	9.35	9.35	0.70	0.70
AVERAGE				AVERAGED VALUE :		1.52
2/22	1.05	9.70	10.35	9.35	-0.35	0.00
2/23						
2/24	1.05	9.70	10.35			
2/25	0.76	11.95	12.19	10.35	-1.60	0.00
2/26	0.76	11.95	12.19	12.19	0.24	0.24
3/01	1.21	13.61	14.28	12.19	-1.42	0.00
3/02						
3/03	1.21	13.61	14.28			
3/04	1.11	14.40	14.91	14.28	-0.12	0.00
3/05	1.11	14.40	14.91	14.91	0.52	0.52
3/08	1.09	14.38	14.89	14.91	0.53	0.53
3/09						
3/10	1.09	14.38	14.89			
3/11	0.92	13.45	13.87	14.89	1.45	1.45
3/12	0.92	13.45	13.87	13.87	0.42	0.42
3/15	1.00	16.01	16.38	13.87	-2.15	0.00
3/16						
3/17	1.00	16.01	16.38			
3/18	1.11	18.68	19.04	16.38	-2.29	0.00
3/19	1.11	18.68	19.04	19.04	0.36	0.36
3/22	1.25	18.63	19.13	19.04	0.41	0.41
3/23						
3/24	1.25	18.63	19.13			
3/25	1.10	20.80	21.00	19.13	-1.67	0.00
3/26	1.10	20.80	21.00	21.00	0.20	0.20
3/29	1.26	22.41	22.69	21.00	-1.41	0.00
3/30						
3/31	1.26	22.41	22.69			
4/01	0.95	22.57	22.52	22.69	0.12	0.12
		Tx	Txs Tx+TSra	AVERAGED VALUE :		0.47 gr/day
4/01	0.95	22.57	22.52	22.69	0.12	
4/02	0	21.24	21.24	22.52		1.28
4/05	0	17.10	17.15			1.34
4/08	0	14.16	14.35			1.17
4/12	0	16.87	17.15			0.49
4/15	0	19.20	19.63			0.21
4/19	0	18.72	19.23			0.18
4/22	0	20.99	21.66			0.04
4/26	0	20.52	21.37			0.05
4/29	0	17.61	18.64			0.14
5/4	0	17.08	18.27			0.13
5/6	0	15.06	16.39			0.17
				AVERAGED VALUE :		0.47

MASS BALANCE OF CPAH

DATE 1993	FEED Ti.CPAH (gr/day)	REACTOR Tx.CPAH (gr)	CPAH Tx+Ti -S1+Trc REMAINED (gr/day)	ACTUAL FEED IN REACTOR (A1) (gr)	T CPAH LOSS A1-Tx (gr)	T CP.... REMOVAL A1-T (gr/d
1/25	7.05	5.92	12.97	7.05	1.13	
1/26	0	6.31	6.31	12.97	6.65	
1/27						
1/28						
1/29	0.33	6.60	6.62			
2/01	0.28	4.48	4.58	6.62	2.15	2.
2/02						
2/03	0.28	4.81	4.90			
2/04	0.29	5.25	5.32	4.90	-0.35	0.00
2/05						
2/07	0.29	5.25	5.32			
2/08	0.29	3.74	3.88	5.32	1.58	1.
2/09						
2/10	0.29	3.74	3.88			
2/11	0.24	2.67	2.82	3.88	1.22	1.22
2/12	0.24	2.67	2.82	2.82	0.16	0.16
2/15	0.30	4.11	4.23	2.82	-1.28	0.
2/16						
2/17	0.30	4.11	4.23			
2/18	0.23	3.74	3.82	4.23	0.49	0.49
2/19	0.23	3.74	3.82	3.82	0.08	0.08
AVERAGE				AVERAGED VALUE :		0.
2/22	0.28	4.06	4.17	3.82	-0.24	0.00
2/23						
2/24	0.28	4.06	4.17			
2/25	0.23	4.30	4.35	4.17	-0.13	0.
2/26	0.23	4.30	4.35	4.35	0.05	0.
3/01	0.24	4.46	4.52	4.35	-0.10	0.00
3/02						
3/03	0.24	4.46	4.52			
3/04	0.20	4.08	4.12	4.52	0.44	0.
3/05	0.20	4.08	4.12	4.12	0.04	0.
3/08	0.30	4.64	4.75	4.12	-0.52	0.
3/09						
3/10	0.30	4.64	4.75			
3/11	0.21	4.06	4.13	4.75	0.69	0.
3/12	0.21	4.06	4.13	4.13	0.07	0.
3/15	0.23	4.61	4.66	4.13	-0.48	0.
3/16						
3/17	0.23	4.61	4.66			
3/18	0.26	5.73	5.76	4.66	-1.07	0.
3/19	0.26	5.73	5.76	5.76	0.03	0.
3/22	0.30	4.78	4.91	5.76	0.97	0.
3/23						
3/24	0.30	4.78	4.91			
3/25	0.21	4.31	4.34	4.91	0.60	0.
3/26	0.21	4.31	4.34	4.34	0.03	0.
3/29	0.28	5.81	5.83	4.34	-1.47	0.
3/30						
3/31	0.28	5.81	5.83			
4/01	0.30	7.35	7.30	5.83	-1.52	0.00
		Tx	Txs Tx+TSra	AVERAGED VALUE :		0. gr/da.
4/01	0.30	7.35	7.30	5.83	-1.52	
4/02		6.57	6.57	7.30		0.72
4/05		6.89	6.91			0.
4/08		5.47	5.54			0.
4/12		4.42	4.53			0.
4/15		4.86	5.01			0.16
4/19		4.05	4.22			0.17
4/22		5.70	5.90			0.
4/26		5.25	5.50			0.
4/29		4.28	4.57			0.
5/4		4.33	4.67			0.08
5/6		4.57	4.94			0.07
				AVERAGED VALUE :		0.

APPENDIX J
INTERNAL AUDIT REPORT AND BAC RESPONSE

Kansi Brown

IT CORPORATION
LIMITED SCOPE
SURVEILLANCE CHECKLIST

Proposal/Project Name: R. F. WESTON
Proposal/Project Number: 408491 Proposal/Project Manager: K. BROWN

Proposal Survey

___ Completed Go/No-Go Form	___ Quality Level Selection
___ Request for Proposal	___ Cost Calculations Verified
___ Document Review	___ Proposal Issuance Checklist

Project File Survey (identify only those categories reviewed)

A ✓ A. Correspondence	___ J. Miscellaneous:
— B. "Blank":	___ K. Lab Data/Chkprints
A C. Typed Originals	___ L. Regulatory Submittals
A D. Copies of Contracts/Proposal	___ M. Reference Materials
___ E. Field Data/Chkprints	___ N. Site IH Monitoring
A F. Calculations/Chkprints	A O. Drawing/Table Chkprints
A G. Reports from Others	___ P. Project Mgt. Records
___ H. Copies of IT Deliverables	A Q. QA Documentation
___ I. Photographs/Negatives	___ Other:

A=Acceptable, U=Unacceptable, I=Incomplete

Findings

1. All files were acceptable
2. ___
3. ___

Corrective Actions

Responsible Person	Action to be Taken	SCD	ACD	QAValid
1.				
2.				
3.				

SCD=Scheduled Completion Date, ACD=Actual Completion Date

Comments

Surveillance Performed By: James J. Kirk 12-5-93
Print/Signature Date

cc: Proposal/Project Manager: ___
S. Alvanas Central Files: ___ Q Other:

QH-F42-R4
Rev. DRAFT

INTERNATIONAL TECHNOLOGY CORPORATION

Memorandum

To: K. Brown, Knoxville

Date: February 8, 1993

From: J. King, Knoxville

Subject: **R.F. WESTON PROJECT FILE SURVEILLANCE 2/5/93**

On February 5, 1993 I performed a project file surveillance on R.F. Weston (Project No. 408491). The purpose of this surveillance is to verify that the IT QA program requirements as well as the project specific requirements have been met.

File A - Correspondence: Incoming

- Page 2 of letter form Douglas Hanify, EIMCO Process Equipment Company, November 20, 1992 does not appear to have page 1.
- Fax from Kerr-McGee Corporation has portions which are blackened out by fax transmission.

File A - Correspondence: Outgoing

- All out going correspondence appears to be in order.

File C - Test Plan Revision (2)

- Both documents are originals and not marked up drafts.

File C - Contract

- This file is in order.

File D - Bids, Contracts and Specifications: Proposal

- This file is in order.

File F - Calculations and Calculation Checkprints

- This file is in order.

JJK/02-93/SMC/JJK180

File G - Reports from Others

- This file is in order.

File H - IT Reports

- This file contained two final reports.

File O - Drawings and Table Checkprints

- This file is in order.

File Q - Quality Records

- This file is in order.

After performing this project surveillance for the R.F. Weston job, it appears the file is complete and in compliance with IT QA procedures.

JJK/02-93/SMC/JJK180

INTERNATIONAL TECHNOLOGY CORPORATION

Memorandum

To: Kandi Brown

Date: April 7, 1993

Corrected Report Date: April 16, 1993

From: Patti Carswell PBC

Subject: **Weston Project Audit Report**

An audit was performed by Merle Keever and myself on April 1 and 2, 1993 of the IT Corporation Biotechnology Application Center (BAC) in Knoxville. The scope of the audit was to determine compliance of work being performed on the above named project with the project work plan ("Test Plan-Phase I Treatability Study of Bioslurry Treatment Technology", final version September 1992). The bioslurry reactor study was in progress at the time of the audit and sampling was observed on Thursday, April 1. In addition to the project audit, a limited quality system audit was also performed. The project audit was based on a checklist generated from a review of the Work Plan. The system audit was based on the ITAS FY92 audit checklist and covered only the areas that were applicable to the BAC. The documentation looked at during the audit included analytical raw data and laboratory notebooks from both the reactor study and the batch slurry testing and the project files at both the BAC and IT Central Files.

The IT associates interviewed during the audit were Janet Rightmyer, Craig Lang, Keith Hague, and Randy Dameron. The project work appeared to be very well managed and performed by technically competent and well trained individuals. All associates were open and helpful in supplying answers to our questions and in providing explanations. The BAC facility is in excellent condition, well-equipped and maintained.

In summary, the Biotechnical Applications Center appears to be an excellent laboratory based on the technical expertise of its personnel, on the condition of the facility and instrumentation/equipment, and on the technical degree of the work being performed there. The main areas that need strengthening from a quality standpoint are documentation, generation of paper trails, and equipment calibrations (pipetters, balances, and thermometers).

All recommendations and suggestions for quality improvement are meant to be constructive in nature and should be evaluated as such. All recommendations for improving documentation, paper trails, and equipment calibrations should be implemented as soon as possible. Merle and I would be happy to help out with implementation of the recommended changes to the existing quality program at the BAC if you should request our services.

Attached is an Audit Observation/Recommendation Report (Attachment A). Also attached is the Test Plan Checklist. Please call me at 690-3211 (ext. 5610) if you have any questions.

PBC\WESTON.AUD

ATTACHMENT A

AUDIT OBSERVATION/RECOMMENDATION REPORT

AUDIT OBSERVATION/RECOMMENDATION REPORT IT BIOTECHNOLOGY APPLICATION CENTER PROJECT: WESTON AUDIT DATES: April 1-2, 1993		
No.	**Observation**	**Recommended Corrective Action**
1.	All daily project data/information was being recorded in a single laboratory notebook.	Dedicate separate notebooks for the reactor log and analytical information/data. In addition, it is highly recommended that an instrument logbook (run log) be assigned to each analytical instrument (GCs, etcs.) This log would document each injection (standard, QC sample, sample, solvent blank, etc.) and would include information such as date, operator, sample ID number, and filename at a minimum. Run logs provide evidence of when analyses were performed and on what particular instrument. Instrument run logs are instrument-specific, not project-specific and should also include documentation of preventive maintenance. It is also recommended that a notebook be dedicated and assigned as a Master Sample Logbook. All samples received at and all samples generated at the BAC should be logged into this logbook and assigned a unique sample ID number. Other suggestions for using laboratory notebooks are suggested throughout this report.
2.	Reactor sample ports were not identified.	Even though the scientists maintaining the reactor (and sampling) were aware of what port was S1, S2, and S3, these ports should be labeled.
3.	There was no evidence that the thermocouple on the reaction vessel had been calibrated.	If not already done, calibrate thermocouple.

AUDIT OBSERVATION/RECOMMENDATION REPORT IT BIOTECHNOLOGY APPLICATION CENTER PROJECT: WESTON AUDIT DATES: April 1-2, 1993		
No.	**Observation**	**Recommended Corrective Action**
4.	It was possible, but difficult to trace sample concentrations from the reactor logbook to the analytical raw data (chromatograms) for both the batch slurry testing and the reactor study. The only way to do this was to match up "hits" (or positive sample concentrations).	Generate a new sample numbering system that includes (for example): (Notebook No.)-(Page No.)-(then the existing sample identification). This would provide easy traceability of sample numbers. Rolls of pre-numbered sample numbering tape are available commercially.
5.	Dissolved oxygen calibrations had been performed but had not been documented.	Record DO calibrations in a laboratory notebook.

AUDIT OBSERVATION/RECOMMENDATION REPORT IT BIOTECHNOLOGY APPLICATION CENTER PROJECT: WESTON AUDIT DATES: April 1-2, 1993		
No.	**Observation**	**Recommended Corrective Action**
6.	Equipment calibrations for balances, thermometers, and pipetters had not been performed.	All equipment that is being used during bench scale testing and analytical analysis should be assigned a calibration schedule. The balance being used had been calibrated externally in 6/92. This is due again in 6/93. The certificate of the 6/92 calibration should be located and filed in an appropriate place. <u>Following are ITAS requirements:</u> Pipetters must be calibrated annually. Thermometers must be calibrated against a certified reference thermometer (that can probably be borrowed from a local ITAS laboratory) annually. The certified reference thermometer must be recertified every three years. Balances must be calibrated quarterly and undergo external calibration and servicing annually In order to perform balance calibrations, Class S weights must be obtained. Class weights must be calibrated annually. It is recommended that Standard Operating Procedures (SOPs) be generated for these equipment calibrations. SOPs can be easily generated through modification of existing ITAS laboratory SOPs.
7.	Refrigerator temperatures have not been monitored.	All refrigerators and ovens that are designated for samples or standards should contain calibrated thermometers immersed in a liquid. The temperature should be checked and recorded on a daily log with acceptance criteria clearly posted.

AUDIT OBSERVATION/RECOMMENDATION REPORT IT BIOTECHNOLOGY APPLICATION CENTER PROJECT: WESTON AUDIT DATES: April 1-2, 1993		
No.	**Observation**	**Recommended Corrective Action**
8.	The requirement for QC samples for the PAH analysis (Matrix Spikes (MS) and Blanks) is not being fully met. Matrix Spikes were being analyzed, but Method Blanks were not. These are required for at least 10% of the samples analyzed.	Begin analyzing Method Blanks (MB) in the PAH analysis immediately. The MB must go through the entire sample preparation and any cleanup procedures and the analysis along with the samples. Since the reactor samples contained numerous hits, a "clean" MB is required in order to rule out laboratory contamination. This observation was conveyed to laboratory personnel during the audit.
9.	BTX analysis was required for both the batch slurry testing and the reactor study. Due to the results from the batch slurry testing (non-detects), BTX analysis was not being performed internally. (A sample(s) was being sent out for BTX analysis at the time of the audit.)	Ensure that a change order has been filed for this procedural change.
10.	The sample waste area was located out in the open in the lab area. The backlog of sample/laboratory chemical waste was significant.	Isolate the waste disposal area to prevent personal exposure and laboratory contamination of samples/standards. The laboratory personnel need instruction on how to dispose of waste.
11.	Samples and standards were stored in the same refrigerator.	Dedicate two refrigerators for samples and standards. These should not be stored together due to the possibility of contamination of the samples or the standards.
12.	Spreadsheets that are internally generated to perform data manipulations are required to undergo validation/verification procedures.	Spreadsheets (if used) should undergo some type of verification procedure if this has not already been done.

AUDIT OBSERVATION/RECOMMENDATION REPORT IT BIOTECHNOLOGY APPLICATION CENTER PROJECT: WESTON AUDIT DATES: April 1-2, 1993		
No.	**Observation**	**Recommended Corrective Action**
13.	There was no evidence that spike concentrations (for MS samples) had been recorded. Also, analytical standards information was not available.	All standards information should be documented in a laboratory notebook. This would include information such as the manufacturer, the concentration, and any dilutions made by the lab. It is recommended that either a Sample Tracking Sheet or the instrument run log be used for recording sample information such as spike solution identification and spike volume. Spike concentrations (or weights) must be traceable.
14.	The HPLC conditions being used for the PAH analysis and the GC conditions used for the BTX analysis were not available.	Record all HPLC conditions in the project records (preferably the run log). Also record the GC conditions used for the BTX analysis during the batch slurry testing. This information includes at a minimum: the temperature program: initial temperature, initial hold time, temperature ramp, final temperature, final hold time, injector temperature, detector temperature, gases used as carrier and auxiliary with flow rates, column identification, total run time *The documentation of the HPLC and GC conditions along with an instrument run log will help provide traceability of analytical results and will allow for the analysis to be duplicated in the future if necessary.

AUDIT OBSERVATION/RECOMMENDATION REPORT IT BIOTECHNOLOGY APPLICATION CENTER PROJECT: WESTON AUDIT DATES: April 1-2, 1993		
No.	**Observation**	**Recommended Corrective Action**
15.	The methods cited in the Test Plan are modified SW-846 Method 8020 and Method 8310. There was no record of the modifications and personnel did not have access to these methods.	Obtain copies of these methods and keep them in the laboratory for reference. The HPLC/GC scientists/operators should become familiar with these methods and should be aware of all modifications being employed (example: Five initial calibration standards are required for PAH analysis, but only three are being used). Also become aware of sample holding time requirements of the methods. With the rapid turn-around-time being achieved, this may not be a problem. However, if any holding times were missed, this should be documented with a nonconformance form that should end up in the project file.
16.	Detection Limits were not yet established.	Detection Limits (PAHs) had already been discussed in detail prior to the audit. These (when determined) should be traceable to all analytical results and should be reported with the data.
17.	One set of Matrix Spike samples had low recoveries (PAH analysis).	Check QC recovery criteria for MS samples. If recoveries were out of acceptance range, this should be documented on a nonconformance form that should end up in the project file.
18.	SPEC and TOC computer printouts had not been saved.	Retain all instrument computer printouts even when data has been transcribed to another document. This is a Test Plan requirement. A folder for each analysis could be used to store these temporarily, before they were placed in the project file.

AUDIT OBSERVATION/RECOMMENDATION REPORT IT BIOTECHNOLOGY APPLICATION CENTER PROJECT: WESTON AUDIT DATES: April 1-2, 1993		
No.	**Observation**	**Recommended Corrective Action**
19.	The Chain-of-Custody for the original sample to be treated was not documented with condition upon receipt.	In the future, the condition upon receipt of the sample(s) should be documented on the original COC along with the inside temperature of the cooler. If the condition is satisfactory, a note such as "Samples intact or OK" should be written on the COC.
20.	Chapter 6 (page 1) states that precision and accuracy determinations, (and detection limits) would be performed prior to study initiation. This has not been done.	Document precision and accuracy requirements (and detection limits as addressed above).
21.	The notebook used as the reactor log had some entries that were not complete. Example: on page 50, there were dates with no entries. Also, on March 29, the volumes removed from and added to the reactor were not documented.	Document all matrices and volumes removed from or added to the reactor.

AUDIT OBSERVATION/RECOMMENDATION REPORT IT BIOTECHNOLOGY APPLICATION CENTER PROJECT: WESTON AUDIT DATES: April 1-2, 1993		
No.	**Observation**	**Recommended Corrective Action**
22.	Notebook recording practices were good, however the following are recommended:	Corrections were made with a single line through the incorrect entry, and initialling the correction. The correction also needs to be dated. Entries that are taped into the notebook need to be signed and dated across the edge of the tape. This is so that if the entry ever falls out of the notebook, half of a signature and date will remain thus proving that an entry was originally present. Not all pages were signed at the bottom as completed. All pages should be signed. Some entries appeared not to have been QC'd. If transcription or calculations have been performed, these need to be QC'd. Units were not always documented and must be.
23.	The DI water purification system is checked every day, but the check is not documented.	Start using a DI water log (notebook) to record daily checks of specific conductance. Clearly post the acceptance limits on or in the notebook.
24.	The percent solids in the six treatments (three duplicate studies) in the batch slurry study were changed from 20% and 30% to 30% and 40% (plus two "killed" studies).	If a variance or change order has not been filed, this documentation should be generated.
25.	The Test Plan states that the treated slurry (bioslurry reactor study) be pumped to a clarifier. This was changed to a centrifuge.	While changes from Test Plans sometimes need to be made (due to improvement of the process, discovering that something determined on paper doesn't actually work, or for whatever reason) the change should be documented on the appropriate form (variance, change order, etc.). This should be done if not already done.

AUDIT OBSERVATION/RECOMMENDATION REPORT IT BIOTECHNOLOGY APPLICATION CENTER PROJECT: WESTON AUDIT DATES: April 1-2, 1993		
No.	**Observation**	**Recommended Corrective Action**
26.	The reactor operating conditions were to be maintained at room temperature, 3 mg/L dissolved oxygen (DO), and pH 7. The actual conditions are room temperature, 5-7 mg/L DO, and a pH of 6.4.	These differences may or may not be significant, however, the reason for the changes should be documented in the reactor log.
27.	Several sampling days were tracked in the reactor log and all contained documentation on the influent waste stream (S1) being characterized for PAH concentrations in the aqueous and solids phase except for the March 29 entry.	Document all sampling events fully in the reactor log.
28.	The operational set points listed on page 5-8 of the Test Plan were being followed with the exception of the agitation rate of 500 rpm. Upon visual inspection, the actual rate appeared to be significantly slower.	Document this change appropriately (nonconformance memo, variance form, or reactor log).
29.	The BAC QA Officer is required to perform monthly surveillances of the IT Knoxville central files. The surveillance and audit requirements stated in the Test Plan are those described in the IT Engineering Operations QA Manual, Rev. 1, July 6, 1990, Chapter 11.0 and the ITAS QA Manual, Rev. 1, Feb. 1, 1988, Chapter 14.0.	These programs were not checked for compliance but should be reviewed by the BAC QA Officer.
30.	MSDSs are required by the Test Plan to be posted near the bioslurry reactor where personnel have access to the hazard information before entering the project area. These MSDSs were not available.	Post MSDSs as required.
31.	According to the Test Plan (and possibly the BAC Chemical Hygiene Plan), satellite waste collection containers are to be used and properly labeled. None were located at the time of the audit.	Begin using properly labeled satellite waste collection containers.

AUDIT OBSERVATION/RECOMMENDATION REPORT IT BIOTECHNOLOGY APPLICATION CENTER PROJECT: WESTON AUDIT DATES: April 1-2, 1993		
No.	**Observation**	**Recommended Corrective Action**
32.	No QA/QC documentation was in hand that could demonstrate cleanliness of sample containers.	Sample bottles shipped with certificates of cleanliness should be used when possible. The certificates should be kept on file for documentation purposes.
33.	The speed control dials for the Rotating Air Lift had no marks indicating what the setting was.	Mark dial settings.

ATTACHMENT B

TEST PLAN AUDIT CHECKLIST

WESTON PROJECT TEST PLAN AUDIT CHECKLIST Audit Dates: April 1-2, 1993			
Item	**Y**	**N**	**Comments**
SECTION 4:			
Were (2) 75 lb composite soil samples shipped to BAC?			1
Were the containers visually inspected and sample volumes recorded?			1
Were the samples automatically logged into a sample tracking system and given independent sample ID numbers?			1
Were the samples refrigerated at 4°C?			1
Is the temperature (4°C) verified biweekly?			1
Once the sample receipt was properly documented was a representative composite of the two samples prepared?			1
Prepared as follows:			
Equal volumes (by weight) composited in ventilated hoods and thoroughly mixed?			1
500 grams of the composite submitted to the laboratory and analyzed for: bulk density, particle size distribution, porosity, moisture liquid/plastic limits, pH, TOC, total heterotrophies and anthracene - degrading microbial populations?			1
Were all volumes of soil removed from the composited fraction logged on "Sample Collection Los" (Appendix B).			1
Was the remaining volume of composited soil stored at 4°C?			1 (All composited test soil was consumed.)
Batch Slurry Testing			
Were the six treatments in Table 3 being evaluated during the six weeks study? (three duplicate studies)		X	See Observation No. 24 of the audit report.
Were Treatments five and 6 used to serve as biologically inhibited controls for the study? (Were these established through the addition of 250 to 500 milligrams per liter of mercuric chloride?)			1

WESTON PROJECT TEST PLAN AUDIT CHECKLIST Audit Dates: April 1-2, 1993			
Item	**Y**	**N**	**Comments**
Have all Treatments covered with aluminum foil to protect from light exposure?			1
Were the batch studies conducted in sterile, glass, sealed, 1-liter (L) bottles?			1
Did the sample collection port on the containers consist of a Teflon screw cap with a Teflon septum?			1
Were samples withdrawn through pipetting?			1
Was hydrocarbon free air introduced into the Treatments following sample collection in order to prevent the creation of a vacuum.			1
Were soils submitted to Eimco, from initial BAC composite, for initial testing to determine the appropriate slurry density and particle size required for bioslurry treatment?			1
Following the determination of optimal slurry density and particle size (above), were site soils prepared for treatment as follows:			1
Soils were slurried and screened to the recommended particle size prior to batch or bioslurry testing?			1
Did the PAH analytical testing prior and following sieving employ the same analytical method for uniformity?			1
Were composited soils placed in bottles at solid densities of 30 and 40 weight percent using the following procedure:			1
Three 280 gram and three 420 gram aliquots of soil (dry weight) are weighed and placed into six, 2-liter glass containers. Sterile distilled DI water is then used to fluidize the samples and bring the volume to 1:4 liter. Approximately 400 ml of this volume is then submitted for initial analysis. The remaining portion is then placed in 1-liter vessels (900 mL sample). (The headspace will allow for oxygen purging)			1
Were the Treatment containers mixed (manual stirring) during the collection of week 3 and week 6 samples?			1

WESTON PROJECT TEST PLAN AUDIT CHECKLIST Audit Dates: April 1-2, 1993			
Item	**Y**	**N**	**Comments**
Were initial determination of the slurry pH and macronutrient (i.e. ammoniacal nitrogen and ortho-phosphate concentrations completed?			1
Was the slurry pH adjusted to 7.0 using either 1 N HCl or 1N NaOH?			1
Were the Treatment macronutrient and dissolved oxygen concentrations maintained at the operating conditions in Table 4?			1
Were the macronutrient concentrations controlled through the addition of ammonium chloride and potassium phosphate to each treatment during the changing of the treatment vessels? (The target C:N:P ratio was 100:10:1.)			1
Were dissolved oxygen measurements made weekly during the course of investigation using a modified, galvanic-cell oxygen probe?			1
Were 1 ml samples collected from each treatment and submitted for this analysis?			1
Was the dissolved oxygen concentration in the treatment vessel maintained between 1 and 3 mg/L?			1
Was this concentration confirmed through daily analysis during the first two weeks of the study?			1
Was the monitoring of dissolved concentration modified to weekly following the first two weeks of the batch testing?			1
Was the maintenance of dissolved oxygen (DO) during batch testing performed through purging of headspace with pure oxygen?			1
Following the preparation, were the treatments placed on the modified-tube rotator, rotated at 6 revolutions per minute, and maintained at room temperature throughout the course of the study?			1
Was the room temperature monitored and recorded weekly in a laboratory notebook dedicated solely to the investigation?			1

WESTON PROJECT TEST PLAN AUDIT CHECKLIST Audit Dates: April 1-2, 1993			
Item	Y	N	Comments
Was approximately 400 mL of the slurry collected during each of the three sampling periods and divided as follows: (or, Was Table 5 followed?)			1
Approx. 30 mL of the slurry submitted for analysis,			1
The remaining approx. 370 mL of the sample separated and analyzed for contaminants in the aqueous and solid phases. (Aqueous and solids phases should be gravimetrically separated with the aqueous phase separated by decanting.)			1
Were PAH, benzene, toluene, xylenes (BTX), macronutrients, pH, oxygen, and TOC monitored at study initiation, Week 3, and Week 6 in the aqueous phase?			1
Were Total solids (TS) and VS concentrations and microbial density of heterotrophic bacteria and anthracene degraders monitored in the slurry phase?			1
Was the soil fraction of each treatment monitored for PAH and BTX concentrations?			1
4.3 BIOSLURRY REACTOR STUDY			
Was feed introduced into the reaction vessel at an average daily flow rate of 2 liters per day?	X		
Following aeration, the treated slurry is pumped to the system clarifier. Was the clarifier covered to reduce the emission of volatile compounds?	X	X	See Observation No. 25.
Before charging the reactor, was the creosote-impacted soil composite (nonfluidized) screened to a particle size of less than 1.0 mm in diameter?	X		
Was the influent slurry prepared in 20-L portions and placed in a closed container?	X		
Was the slurry then continuously stirred to reduce the separation of solids?	X		

WESTON PROJECT TEST PLAN AUDIT CHECKLIST Audit Dates: April 1-2, 1993			
Item	Y	N	Comments
Was a percent solids concentration of the feed determined based on Week-3 data from the batch slurry study?	X		
Are reactor operating conditions maintained at room temperature, 3 mg/L dissolved oxygen, and pH 7?	X	X	See Observation No. 26.
Were the operational set points listed on page 4-8 of the Test Plan used/followed?		X	See Observation No. 28.
Are the operating conditions for temperature, dissolved oxygen, and pH monitored daily?	X		Monday through Friday.
Is the influent waste stream (S1) characterized for PAH concentrations in the aqueous and solids phase twice per week?	X	X	See Observation No. 27.
Is it analyzed for TS and VS concentrations twice per week?	X		
The reactor slurry will be collected form Sample Port S2. Is the reactor slurry particle size being monitored once a week?	X		
Is the reactor slurry phase monitored twice weekly for TS and VS concentrations?	X		
Are microbial enumerations of total heterotrophs and anthracene degraders conducted once per week? (The analysis will be conducted on slurry grab samples collected form sample Port S2.	X		
Are the reactor aqueous-phase macronutrient concentrations monitored once per week to maintain a C:N:P ratio of 100:10:1?			This is not being checked in the lab, but may be monitored by K. Brown.
Is the PAH content of the aqueous and solids phase measured in the RAS (return activated sludge) once per week?	X		
Are TS (total solids) and VS (volatile solids) concentrations of the RAS determined twice weekly in the slurry phase (collected through Sample Port S3)?	X	X	Sampled from centrifuge, not from sample port S3.
Are TS and VS concentrations in the clarified effluent monitored twice weekly (S4)?	X	X	These are monitored from centrifuge samples.

WESTON PROJECT TEST PLAN AUDIT CHECKLIST Audit Dates: April 1-2, 1993			
Item	**Y**	**N**	**Comments**
Is air monitoring for volatiles and semivolatiles conducted weekly?	X		
Is complete mixing of the reactor solids verified periodically during the 40-day BSRT (biological solids retention time) set point? Is this verified through the analysis of sample TS concentrations? Were the samples extracted from the three sample ports located on the side of the bioslurry reactor (to obtain sample material representative of sample material from within the rake-mixing zone, the most well-mixed zone, and any oil phase that may be present)?	X		No oil phase had been seen yet.
Are sample logs maintained in a bound laboratory notebook, solely dedicated for this project?	X		Need to use separate notebook for different information recording. See Observation No. 1.
Section 7.0 DATA MANAGEMENT/QUALITY ASSURANCE			
Are records of all analyses recorded in a bound laboratory notebook dedicated solely to this investigation?	X		See Observation No. 1.
7.1 Data Acquisition			
Are calibration of field and laboratory equipment documented on the appropriate equipment calibration records?		X	
Are equipment that fail calibration taken out of service, and a Notice of Equipment Calibration Failure record completed and maintained in the project file (in Knoxville)?		X	
Is all sampling of experiments and test performed by IT personnel?	X		
Are all variances approved by the project manager and documented on a Variance Log?	X		
7.2 Data Collection Sheets			
Are all data collected during execution of the study recorded in a bound, controlled laboratory notebook?	X		

WESTON PROJECT TEST PLAN AUDIT CHECKLIST Audit Dates: April 1-2, 1993			
Item	**Y**	**N**	**Comments**
Are all data generated from integrators and computerized instruments printed with the resulting data sheets kept with the project file?	X	X	See Observation No. 18.
Are all data verified and checked by a Biotechnology Applications Center scientist? Is this verification documented with a dated signature of the checker at the bottom of each notebook page?	X		See Observation No. 22.
7.3 Data Reduction, Validation, and Reporting			
Are all numerical analyses and results completely documented (calculations, computer programs and associated input/output logs, drawings, and tables)?	X		
Are all calculations legible and in a form suitable for reproduction, filing, and retrieval?	X		
Are calculations performed on standard calculation paper or laboratory notebooks?	X		Notebook.
SECTION 9.0 HEALTH AND SAFETY			
Are all sample preparation and use of carbon adsorption on the exhaust of the sealed bioslurry reactor been performed in a fume hood?	X		
Have all personnel working on the project reviewed the MSDSs and, in addition, are MSDSs posted near the bioslurry reactor where personnel have access to the hazard information before entering the project area?		X	
Are satellite waste collection containers used and are they properly labelled?		X	

[1]The batch slurry testing had already been completed. The requested information was looked for in the notebook used for that testing but could not be located.

INTERNATIONAL TECHNOLOGY CORPORATION

Memorandum

To: Bob Allan, Knoxville

Date: August 7, 1993

From: Kandi Brown, Knoxville

Project No. 408491

Subject: **WESTON AUDIT**

IT Corporation's (IT) Biotechnology Applications Center (BAC) was audited by IT Analytical Services (ITAS) auditors, Patti Carswell and Merle Keever, on April 1 and 2, 1993. In summary, the auditors found the BAC to be an "excellent laboratory based on the technical expertise of its personnel, on the condition of the facility and instrumentation/equipment, and on the technical degree of the work being performed there". Thirty-three observations/recommendations were identified during the course of the audit. The following text details the BAC response to these observations.

cc: J. Hall, ITAS
M. Leavitt, Knoxville

NO.	OBSERVATION	BAC RESPONSE/CORRECTIVE ACTION
1	All daily project data/information was being recorded in a single laboratory notebook.	Analytical run logs were established for each laboratory instrument. A laboratory SOP was created for sample tracking.
2	Reactor sample ports were not identified.	BAC personnel were intimately familiar with all sampling locations. Reactor sample ports were labelled immediately.
3	There was no evidence that the thermocouple on the reaction vessel had been calibrated.	The thermocouple was calibrated by BAC staff on April 16, 1993. Prior to calibration, reference thermometer measured 24.4°C; instrument display read 24°C.
4	It was possible, but difficult to trace sample concentrations from the reactor logbook to the analytical raw data (chromatograms) for both the batch slurry testing and the reactor study. The only way to do this was to match up "hits" (or positive sample concentrations).	The HPLC run log was generated to clearly identify each sample analyzed. Chromatographs were organized by date and maintained in the project file.

NO.	OBSERVATION	BAC RESPONSE/CORRECTIVE ACTION
5	Dissolved oxygen calibrations had been performed but had not been documented.	A run log notebook was created for each laboratory instrument, including the DO probe. All calibrations were routinely recorded.
6	Equipment calibrations for balances, thermometers, and pipetters had not been performed.	The analytical balance used in the project was within the yearly-calibration schedule. The BAC is working with ITAS to generate SOP for equipment calibration.
7	Refrigerator temperatures have not been monitored.	Refrigerator temperatures had been recorded but were maintained in a general laboratory file. Monitoring forms were copied to the project laboratory notebook. Posting of acceptance is in progress.
8	The requirement for QC samples for the PAH analysis (Matrix Spikes (MS) and Blanks) is not being fully met. Matrix Spikes were being analyzed, but Method Blanks were not. These are required for at least 10% of the samples analyzed.	The Test Plan specified that Matrix Spikes and Blanks would be analyzed in at least 10 percent of the samples collected for PAH analysis. The requirements of the Test Plan were fully met with 26 percent of the samples collected analyzed as QC checks. No compounds were detected in the 12 Method Blanks analyzed.

NO.	OBSERVATION	BAC RESPONSE/CORRECTIVE ACTION
9	BTX analysis was required for both the batch slurry testing and the reactor study. Due to the results from the batch slurry testing (non-detects), BTX analysis was not being performed internally. (A samples(s) was being sent out for BTX analysis at the time of the audit.)	A change order documenting this client-requested change was in the project file.
10	The sample waste area was located out in the open in the lab area. The backlog of sample/laboratory chemical waste was significant.	The waste disposal area was isolated and all wastes disposed. No laboratory contamination was evident in the Method Blanks analyzed.
11	Samples and standards were stored in the same refrigerator.	Separate refrigerators were dedicated for sample and standards storage.
12	Spreadsheets that are internally generated to perform data manipulations are required to undergo validation/verification procedures.	All data manipulations spreadsheets had been internally reviewed and were filed in IT Central Files, main office building.
13	There was no evidence that spike concentrations (for MS samples) had been recorded. Also, analytical standards information was not available.	This information was recorded in the HPLC sample method and laboratory notebook.

NO.	OBSERVATION	BAC RESPONSE/CORRECTIVE ACTION
14	The HPLC conditions being used for the PAH analysis and the GC conditions used for BTX analysis were not available.	This information was recorded in the HPLC sample method and project notebook following the audit. HPLC methods had been routinely documented on instrument software.
15	The methods cited in the Test Plan are modified SW-846 Method 8020 and Method 8310. There was no record of the modifications and personnel did not have access to these methods.	Methods were available from several sources, including ITAS and IT central library. The SW-846 series was ordered for the laboratory. Modifications of Method 8310 included 3-point calibration and reduced sample volume. No holding times were exceeded.
16	Detection Limits were not yet established.	An MDL study was not performed. Analytical detection limits were interpolated based upon a response sufficient to produce at least a 3:1 signal to noise ratio, with respect to sample dilution.
17	One set of Matrix Spike samples had low recoveries (PAH analysis).	The Matrix Spike sample (3/19/93) recovery of 52 percent was within the procedure data quality objectives of 50 to 120 percent.
18	SPEC and TOC computer printouts had not been saved.	From April through project completion, copies of all SPEC and TOC computer printouts were saved and filed in the project file.

NO.	OBSERVATION	BAC RESPONSE/CORRECTIVE ACTION
19	The Chain-of-Custody for the original sample to be treated was not documented with condition upon receipt.	In the future, the condition of all samples will be documented on the original COC along with the inside temperature of the cooler (when applicable). The original sample received was intact and ok.
20	Chapter 6 (page 1) states that precision and accuracy determinations, (and detection limits) would be performed prior to study initiation. This has not been done.	The precision and accuracy requirements and DL were not determined prior to project initiation.
21	The notebook used as the reactor log had some entries that were not complete. Example: on page 50, there were dates with no entries. Also, on March 29, the volumes removed were not documented.	All notebook entries were completed following the audit. All matrices and volumes removed or added to the reactor was routinely recorded in the project notebook and maintained on an internally-reviewed, project spreadsheet.
22	Notebook recording practices were good, however the following are recommended: (See Audit Report Attached)	All notebook corrections were dated. All entries that were taped into the notebook were signed and dated across the edge of the tape. All notebook pages were signed at the bottom, following proper quality checks. Units were documented where missing.

NO.	OBSERVATION	BAC RESPONSE/CORRECTIVE ACTION
23	The DI water purification system is checked every day, but the check is not documented.	A DI water log (notebook) to record daily checks of specific conductance was started and maintained throughout remainder of the project.
24	The percent solids in the six treatments (three duplicate studies) in the batch slurry study were changed from 20% and 30% to 30% and 40% (plus two "killed" studies).	A variance was filed. This variance was approved by the client prior to study initiation.
25	The Test Plan states that the treated slurry (bioslurry reactor study) be pumped to a clarifier. This was changed to a centrifuge.	Due to problems in solids/liquid separation, a system clarifier could not be employed. Solids were separated by centrifugation. This variance was communicated to the client when evident.
26	The reactor operating conditions were to be maintained at room temperature, 3 mg/L dissolved oxygen (DO), and pH 7. The actual conditions are room temperature, 5-7 mg/L DO, and a pH of 6.4.	These variances were insignificant, could not be corrected, did not impact biological treatment, and were communicated to the client once evident.

NO.	OBSERVATION	BAC RESPONSE/CORRECTIVE ACTION
27	Several sampling days were tracked in the reactor log and all contained documentation on the influent was stream (S1) being characterized for PAH concentrations in the aqueous and solids phase except for the March 29 entry.	March 29 entry was corrected. It should be noted that the facility lost power and staff was limited on this date due to inclement weather.
28	The operational set points listed on page 5-8 of the Test Plan were being followed with the exception of the agitation rate of 500 rpm. Upon visual inspection, the actual rate appeared to be significantly slower.	A variance in the reactor agitation was noted. This variance had not been communicated to the client since it did not impact operations. Although the agitation rate was <500 rpm, TS mixing was uniform throughout the reactor and the DO was >3 mg/L.
29	The BAC QA Officer is required to perform monthly surveillances of the IT Knoxville central files. The surveillance and audit requirements stated in the Test Plan are those described in the IT Engineering Operations QA Manual, Rev. 1, July 6, 1990, Chapter 11.0 and the ITAS QA Manual, Rev. 1, Feb. 1, 1988, Chapter 14.0.	One audit of the project file were conducted by BAC personnel. ITAS also conducted an audit of the BAC laboratory and limited audit of the project file. The study duration was 3-4 months. Also during this period, routine maintenance of project files was supervised by the project QAO and manager.

NO.	OBSERVATION	BAC RESPONSE/CORRECTIVE ACTION
30	MSDSs are required by the Test Plan to be posted near the bioslurry reactor where personnel have access to the hazard information before entering the project area. These MSDSs were not available.	MSDSs were provided to all BAC personnel prior to study initiation. In addition, MSDSs were posted in the reactor area. (The MSDSs had been moved for cleaning purposes during the audit; they were replaced immediately.)
31	According to the Test Plan (and possibly the BAC Chemical Hygiene Plan), satellite waste collection containers are to be used and properly labeled. None were located at the time of the audit.	All project wastes had been separated. Following the audit, all satellite containers were labelled.
32	No QA/QC documentation was in hand that could demonstrate cleanliness of sample containers.	Sample bottles had been shipped with certificates of cleanliness. These had not been filed. Following the audit, certificates were kept on file for documentation purposes.
33	The speed control dials for the Rotating Air Lift had no marks indicating what the setting was.	The Eimco O&M Manual indicated all speed control dial settings. This manual was available to all BAC staff. Records of daily settings were maintained on an internally-reviewed, project spreadsheet.