



DEPARTMENT OF THE ARMY  
U.S. ARMY EDGEWOOD RESEARCH, DEVELOPMENT AND ENGINEERING CENTER  
5232 FLEMING ROAD  
ABERDEEN PROVING GROUND, MARYLAND 21010-5423

REPLY TO  
ATTENTION OF

SCBRD-ODR-S (385-11a)

7 May 1998

MEMORANDUM FOR: U.S. Nuclear Regulatory Commission, ATTN: Mr. Anthony Dimitriadis, Region I, 475 Allendale Road King of Prussia, Pennsylvania 19406-1415

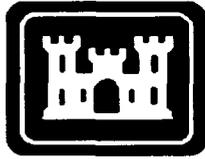
SUBJECT: Final Release Survey Report for the Westwood Radioactive Material Disposal Facility - License No. 19-10306-01(20), Docket No. 030-04552

1. The report entitled "Final Release Survey Report for the Westwood Radioactive Material Disposal Facility" is enclosed for your review. The Westwood Radioactive Material Disposal Site is located at the Edgewood area of the Aberdeen Proving Ground, Maryland, and the removal action was completed under NRC License No. 19-10306-01(20), Docket No. 030-04552.
2. This report summarizes the work done remediating the Westwood Radioactive Material Disposal Facility (WRMDF) and describes the final radiological conditions present. It is a conclusion of this report that the site meets the criteria for release from inclusion in the U.S. Nuclear Regulatory Commission License Number 19-10306-01(20). The release criteria are defined as an average soil concentration of less than 15 pCi/g cesium-137, and a maximum concentration not to exceed three times that value. These criteria support the achievement of conditions whereby no person is likely to receive a dose (total effective dose equivalent) in excess of 25 mrem/year.
3. The report contains a description of the final termination survey plan and presents the results of that plan and supporting detail. We request your review of the report, your concurrence that the release criteria are met, and the removal of the Westwood Radioactive Material Disposal Facility site from the Licence
4. Should there be any questions regarding the report, please contact Mr. Rafael Corpuz at the Aberdeen Proving Ground Health Physics Office at (410) 278-9025.

Encl

PETER SPAETH  
ERDEC Radiation Protection  
Officer

1 2 5 6 9 0  
MAY 15 1998



US Army Corps  
of Engineers  
Baltimore District

**ENVIRONMENTAL  
REMEDiation  
RESIDENT OFFICE**

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**FINAL RELEASE SURVEY REPORT for the  
WESTWOOD RADIOACTIVE MATERIAL  
DISPOSAL FACILITY**

**ABERDEEN PROVING GROUND, MD  
EDGEWOOD AREA**

**Prepared by  
Foster Wheeler Environmental Corporation  
for the  
U.S. Army Corps of Engineers and Directorate of Safety,  
Health, and Environment-Radiation Protection Office  
NRC License No. 19-10306-01(20), Docket No. 030-04552**

**April 28, 1998**



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FINAL RELEASE SURVEY REPORT  
FOR THE  
WESTWOOD RADIOACTIVE MATERIAL DISPOSAL FACILITY

Work performed under Contract Number DACA31-94-D-0020

Delivery Order No. 0003, Site No. 12

April 28, 1998

Prepared by

FOSTER WHEELER ENVIRONMENTAL CORPORATION

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FINAL RELEASE SURVEY REPORT  
FOR THE  
WESTWOOD RADIOACTIVE MATERIAL DISPOSAL FACILITY

**1.0 Introduction and Background**

The U.S. Army Corps of Engineers, Baltimore District-Environmental Remediation Resident Office, (USACE-ERRO), provides environmental remediation support to the U. S. Army Garrison, Aberdeen Proving Ground (APG) Environmental Conservation and Restoration Division (ECRD) for removal activities negotiated between the U.S. Department of the Army and the U. S. Environmental Protection Agency (USEPA). As part of this support USACE-ERRO employs contracted Removal Action (RA) and analytical laboratory services. Foster Wheeler Environmental Corporation was tasked by USACE-ERRO to remove underground pipes and equipment and radioactively contaminated soil from the Westwood Radioactive Material Disposal Facility (WRMDF). Preparatory work began in May, 1997. The excavations were initiated in August, and the final material removal was completed in January 1998. This document describes the process used to determine whether or not the "as-remediated" site meets the criteria for release from radiological controls, and the basis for concluding that it can be released from U.S. Nuclear Regulatory Commission License Number 19-10306-01(20). Considerations regarding residual hazardous (non-radioactive) materials are to be addressed for the site as a whole through future regulatory decisions.

**1.1 Site History**

The Westwood Radioactive Material Disposal Facility site is located south of the old Magnolia Road gate adjacent to the installation boundary of the Edgewood Area of the Aberdeen Proving Ground, Maryland as shown in Figure 1-1. It was formerly used to process and package radioactive waste prior to disposal. The facility was first used as a waste handling facility and later for radioactive waste research and development. Reportedly, no actual disposal of radioactive waste material was performed onsite.

Figure 1-2, Site Configuration gives details of the site. Former structures at the WRMDF site include Building 3013 and adjacent concrete slabs where waste handling work was accomplished: a small equipment shed (Building 3012); and a wastewater holding and drain systems which included tanks in a concrete pit. Wastewater from the tanks was discharged to the Reardon Inlet south of the site.

The original discharge line from the western end of Building 3010 ran south-southeast toward Rearden Inlet, and was separate from the system which handled low-level radioactive wastewater. Detailed information concerning the types of radioactive waste materials handled at the WRMDF is not available.

An upgrade of the system shown on a July, 1967 drawing included the construction of a 625 gallon septic tank, a sand filter, and a chlorine contact chamber. However, the site was not being used for handling radioactive waste at that time. In the early 1970s all of the buildings were removed including the concrete tank pit. Underground pipes and equipment were left in place and the site left undisturbed until 1994. At that time the former building site existed as an open grassy area, and the only visible features were the outlets of three separate pipes and a headwall where discharges from the easternmost pipe formerly emptied into the inlet. That line had been extended about 150 feet further into the marsh sometime in the past.

In September, 1994 Weston Environmental Services conducted a geophysical survey, identifying two pipes and a linear path of high conductivity trending southeast from the sand filter toward the marsh. The East Pipe runs SSE from the area of the former tank pit to the headwall, and then an additional 150 feet into the marsh.

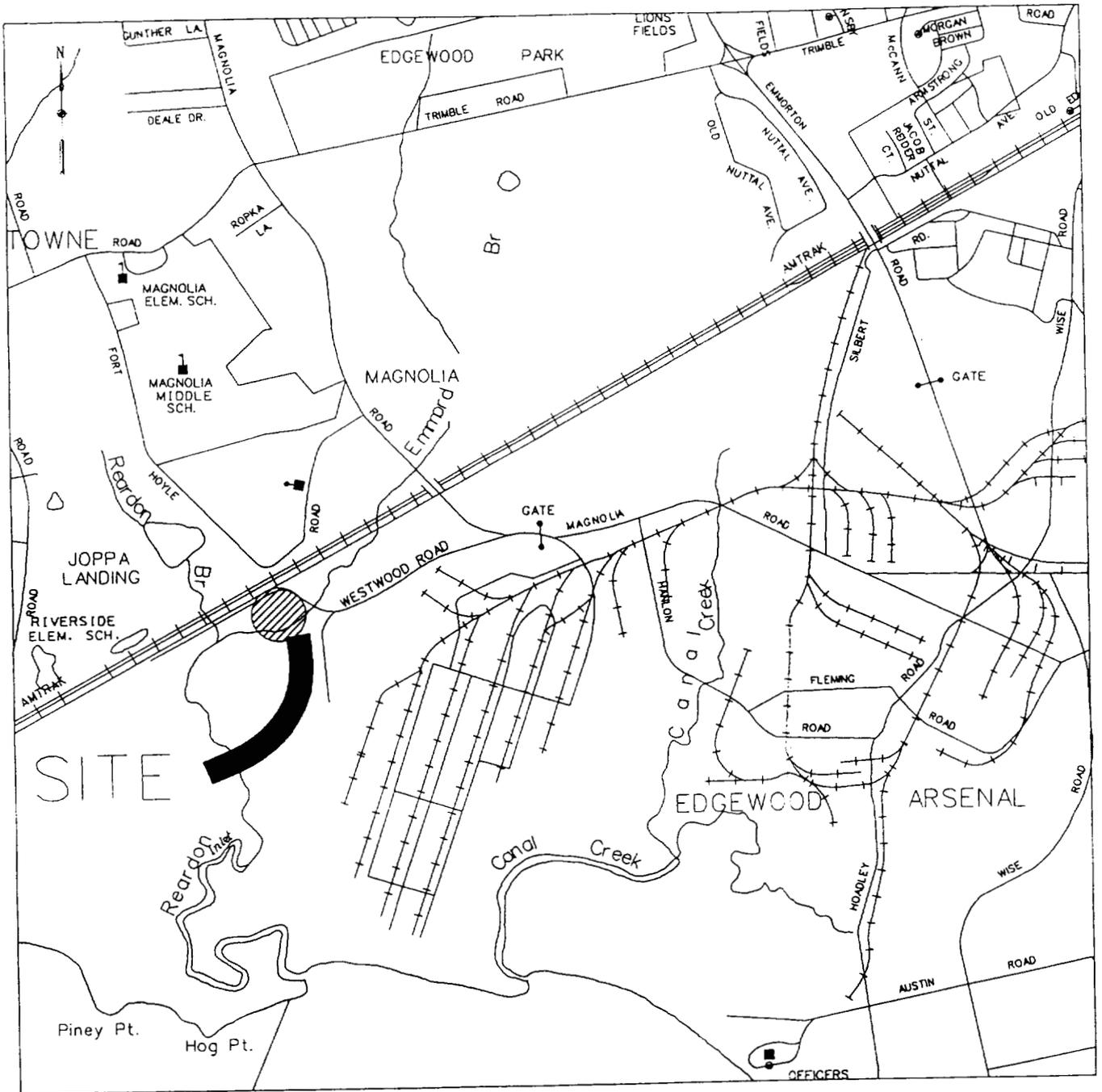
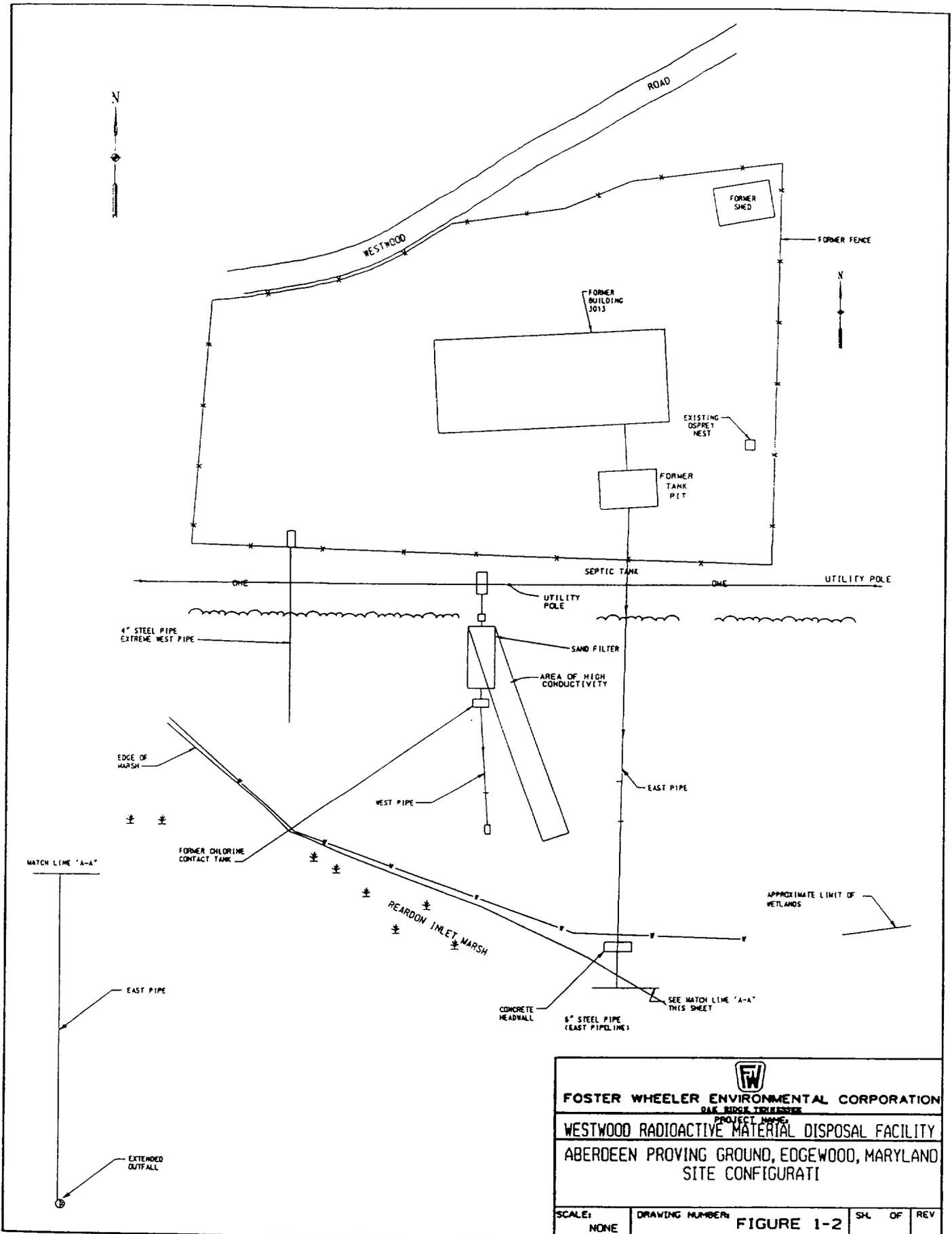


Figure 1-1. Site Location Map



 <b>FOSTER WHEELER ENVIRONMENTAL CORPORATION</b> <small>DAK RIDGE, TENNESSEE</small> PROJECT NAME			
<b>WESTWOOD RADIOACTIVE MATERIAL DISPOSAL FACILITY</b>			
<b>ABERDEEN PROVING GROUND, EDGEWOOD, MARYLAND</b> <b>SITE CONFIGURATION</b>			
SCALE:	DRAWING NUMBER:	SHEET OF:	REV:
NONE	FIGURE 1-2		

The northern end of this pipe could not be found and may have been removed. The West Pipe was found running SSE from the location of the septic tank about 150 ft to the marsh. The Extreme West Pipe was found to run parallel to the two other pipes. It was about 65 feet long and buried about 18 inches deep.

## 1.2 Site Characterization

Seven soil samples were collected from various locations and analyzed by Jacobs Engineering in September, 1994. A number of contaminants were found in low concentrations, and low gross alpha and beta concentrations were discovered; the gross alpha concentration ranged from 6 to 23 picocuries per gram (pCi/g) and the gross beta concentration ranged from 9.2 to 17 pCi/g<sup>(1)</sup>.

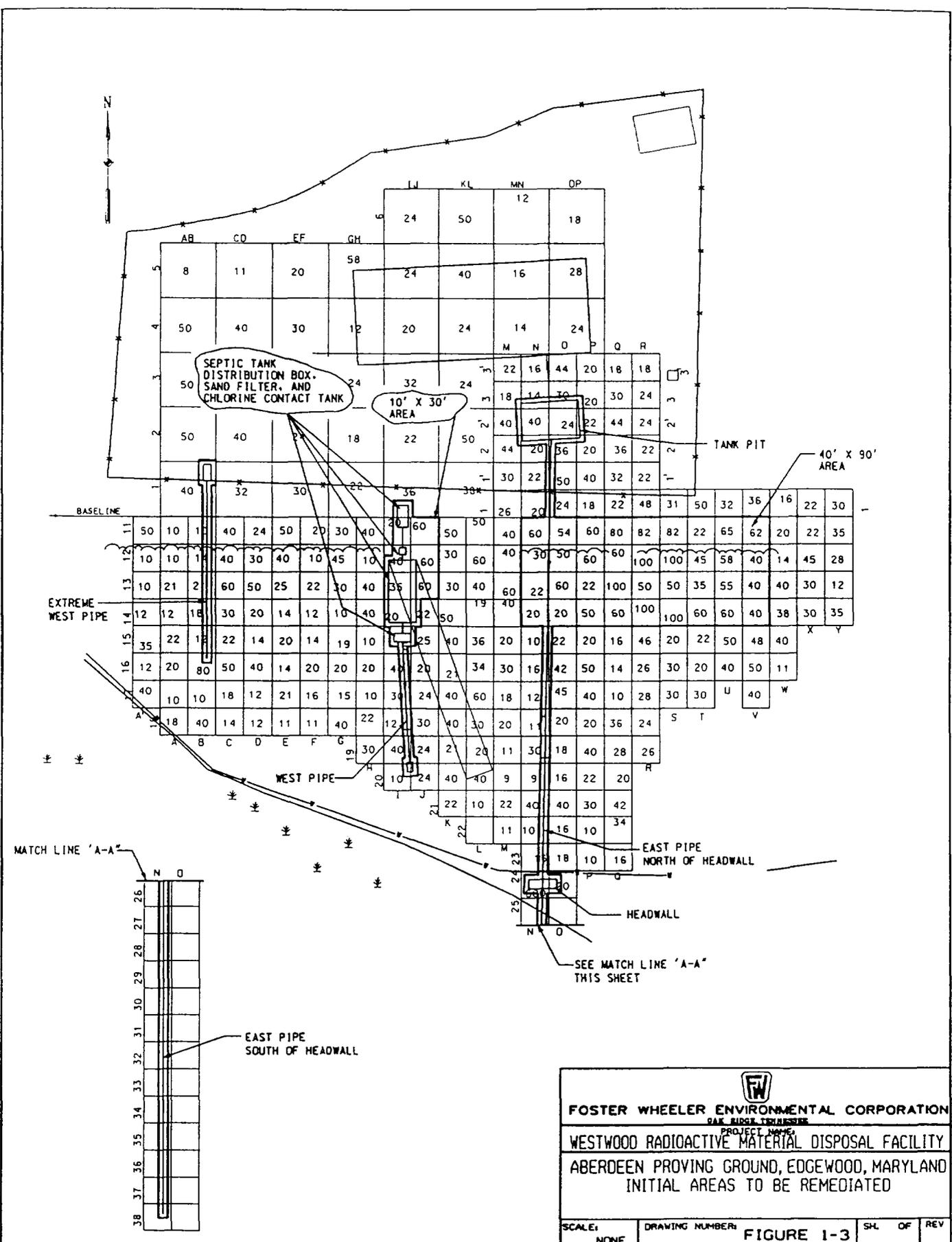
EA Engineering Science and Technology Inc. (EA) reviewed this data and conducted a radiological survey of the site in August and September, 1995. They found some areas with beta and gamma background rates more than twice background. As part of this survey EA also took 22 soil/sediment/subsurface soil/sludge samples and analyzed them for radioactivity. Eight of the samples were found to contain concentrations of cesium-137 in excess of the then current Nuclear Regulatory Commission cleanup criterion<sup>(2)</sup> of 15 pCi/g. Based on this data EA developed a plan for a focused Removal Action (RA) to remove the remaining underground pipes and equipment, the headwall and soil contaminated with cesium-137 in excess of 15 pCi/g<sup>(3)</sup>. Figure 1-3 shows the layout of the three pipes and the associated underground equipment anticipated, as well as the adjacent 10 ft x 30 ft and 40 ft x 90 ft soil removal areas based on the 10 ft grid established by EA.

## 1.3 Preliminary Site Evaluation

Foster Wheeler Environmental was tasked with performing the removal action in accord with the EA study. The need for additional data was identified early in the preparation of the Work Plan and plans were made for a preliminary site evaluation<sup>(4)</sup>. The purposes of this evaluation were the following:

- to establish the site boundary by civil survey and to demonstrate that it effectively bounded the contamination
- to collect and analyze soil samples to obtain advance approval to dispose of soil at Envirocare of Utah, Inc., for soil containing >15 pCi/g Cs-137, and to obtain approval to reuse excavated soil on site that contained <15 pCi/g Cs-137
- to establish a field screening protocol to relate field measurements to soil concentrations and optimize the cost of collecting data during operations, and to minimize that amount of material that would have to be disposed of off site.

The Preliminary Site Evaluation was completed in May, 1997. One result of the evaluation was the discovery of some contamination >15 pCi/g outside of the initial boundary. Consequently, the boundary was expanded to accommodate two areas, one to the north and one southeast. Secondly, analytical results were sent to Envirocare of Utah and approval was obtained to dispose of radiological contaminated soils at their site in Clive, Utah. This information is also being submitted to the USACE to obtain permission to reuse excavated soils having a concentration of <15 pCi/g Cs-137. Finally, a protocol was developed relating the count rate measured six inches above the surface to the corresponding concentration of Cs-137 in the soil. A portable ratemeter/scaler was used in conjunction with a 2"x2" sodium iodide (NaI) detector to measure the count rate, and a single channel analyzer inherent to the instrument excluded all counts except those with the energy of



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PROJECT NAME: <b>WESTWOOD RADIOACTIVE MATERIAL DISPOSAL FACILITY</b>			
<b>ABERDEEN PROVING GROUND, EDGEWOOD, MARYLAND</b> <b>INITIAL AREAS TO BE REMEDIATED</b>			
SCALE:	DRAWING NUMBER:	FIGURE 1-3	SHEET OF REV
NONE			

the Cesium-137 gamma ray, i.e., 0.662 MeV. The soil samples taken from each location where a field measurement was made were analyzed by Environmental Physics, Inc. The protocol which resulted from merging these two data sets is attached in Appendix 1.

#### **1.4 Physical Removal**

With the approval of the Work Plan<sup>(5)</sup>, excavation of the soil, pipes and underground equipment began in August, 1997. Figure 1-3 shows the areas to be excavated and the pipes and equipment to be removed. The Extreme West Pipe was removed first, working south to north. Excavated soil shown by field measurement to meet the release criteria was stored in roll-off boxes, and contaminated soil exceeding the release criteria was placed directly into intermodal containers for shipment to Envirocare. All pieces of the ceramic pipe were considered contaminated and added to an intermodal container. Surveys were made of the radioactivity remaining after pipe removal and additional soil was only removed if the field measurement showed that it exceeded criteria. The results of the field screening measurements were confirmed by taking soil samples for on-site analysis using a 3x3 inch sodium iodide detector and multichannel analyzer. On confirmation that the residual was compliant with the release criteria samples were taken for analysis by an off-site analytical laboratory. The results of the off-site analysis were used to help verify that the site met release criteria.

The West Pipe was removed in a similar fashion, again proceeding south to north. Pieces of pipe were all transferred to an intermodal. The chlorine contact chamber, sand filter and distribution box that were expected to be in this system were not found. The pipe was removed all the way to the septic tank. The septic tank was removed and cut into appropriate sizes as necessary to meet the Envirocare waste acceptance criteria. Contaminated soil was found both east and west of the West Pipe excavation using field measurements. This soil was removed and transferred to an intermodal. This removal included the soil in the 10'x30' area identified in Figure 1-3. However, the contamination was found to extend beyond these boundaries, both in extent and depth, i.e., greater than one foot. As in the case of the Extreme West Pipe, samples were taken from random locations along the excavation of the pipe, and under the septic tank.

The third phase of the RA consisted of the removal of the steel pipe south of the headwall in the marsh. It was found that this line was close to the surface and sometimes accessible without digging. The entire length of the pipe was uncovered by hand, and sections were pried up and sectioned using a cut-off saw. A catch containment was installed under the cut line to catch any contents of the line should they leak during cutting. However, contents were found to be substantially solid, like packed mud, and did not fall out of the pipe. Nevertheless, the ends of the pipes were wrapped and the pipes transferred to an intermodal container. Residual soil was surveyed using field measurements. These were confirmed by analyzing random soil samples using the on-site 3x3 system. Verification samples were taken for off-site analysis from random locations inside of the excavation.

The headwall was removed, sized and placed in an intermodal. Soil adjacent to the headwall was also removed, as this had been the location of the highest concentrations noted during the preliminary evaluation. Removal proceeded to the water level and beyond as long as the concentration exceeded 15 pCi/g. This was determined by field measuring each bucketful of soil as it was removed, and frequently taking and analyzing soil samples using the on-site 3x3. The total depth of the excavation reached 7 feet below the water level in the adjacent marsh. After the contaminated soil was removed the excavation of the ceramic section of the East Pipe proceeded northward. During excavation radiological levels in the soil were measured using the field instrument, a 2"x2" NaI detector and ratemeter/scaler. Soil meeting criteria for reuse was placed in a rolloff box, and contaminated soil and pieces of the pipe were placed in an intermodal. Most of the soil above the

East Pipe was found to be non-contaminated. After removal of the pipe, the residual soil was surveyed using the field instrument, and random soil samples were taken for on-site analysis. When both measurements indicated that the residual soil met the release criteria, samples were taken for off-site confirmatory analyses.

The last phase of the RA consisted of both the removal of contaminated soil from the 40 ft x 90 ft envelope shown in Figure 1-3 and the excavation of the remaining sections of the East Pipe, since the scopes of these actions overlap. The top foot of soil in this area was surveyed and removed. When it was found to be non-contaminated (<15 pCi/g) it was placed in a roll-off box. Contaminated soil and debris were placed in an intermodal. When the radioactivity in the underlying soil still exceeded the 15 pCi/g limit, it too was removed for disposal and placed in the intermodal containers.

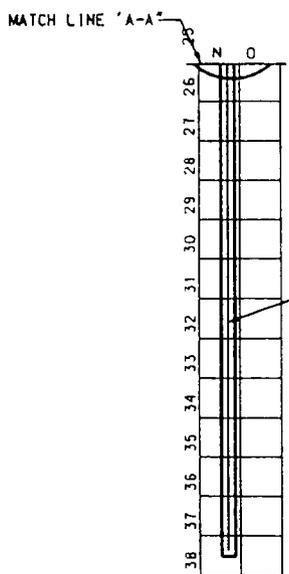
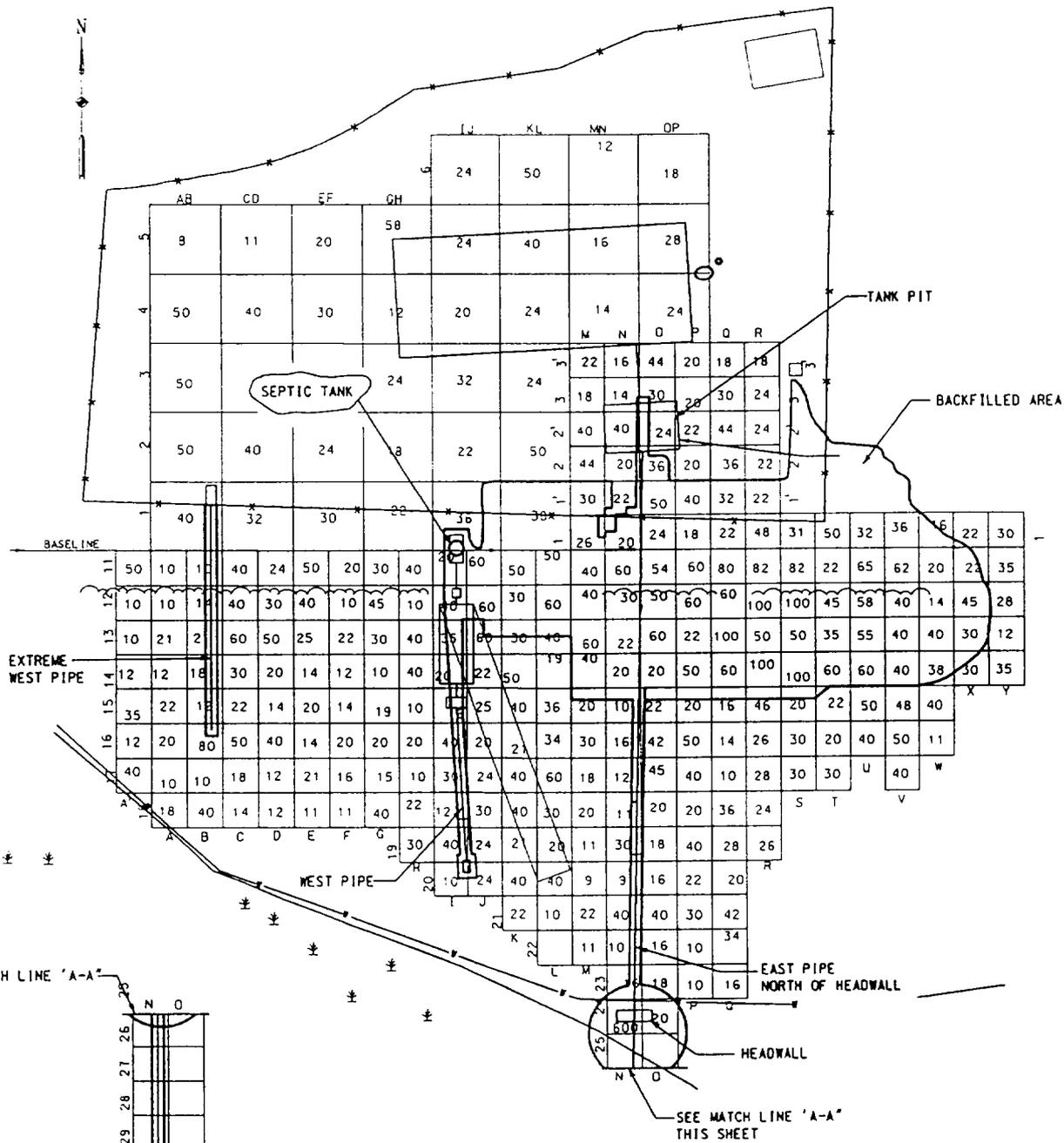
However, during this time the portable 2"x2" NaI detector/scaler/ratemeter became due for calibration. To avoid down-time, a second newly factory-calibrated instrument using different voltage, threshold, and window settings from those used in the Preliminary Site Evaluation was used. An adjustment to the field limit had to be made as the parameters of the second instrument changed the efficiency of the field measurement. This was done by making pairs of measurements of soil samples previously taken. The samples were chosen to get a wide variety of activities, from barely detectable concentrations of Cs-137 to samples having among the highest seen at the time. Equivalent measurements were made using the instrument used during the Preliminary Site Evaluation, and the second, newly-(factory)calibrated instrument. A ratio was determined for each of the pairs, and averaged to determine the new field limit. It was found to be 238 counts per minute (CPM). Appendix 2 gives the results of these measurements and provides the basis for the new field limit. Appendix 3 gives the methodology for converting CPM as measured with the field instrument into units of  $\gamma/\text{cm}^2\text{sec}$ .

Frequent surveys were made of the residual soil and each bucket of soil as it was removed (now using the revised field limit) to determine whether to keep digging, and whether to place the soil in a roll-off or intermodal. Excavations in this area proceeded to a depth of approximately 10 ft. At that level groundwater was encountered. During the excavation of this area, and the removal of the remainder of the East Pipe a variety of debris was discovered including plastic bags and broken masonry. This suggested that during previous cleanup, foundation areas had been backfilled and accounts for the increase in the extent of contamination estimated.

Contaminated soil beyond the boundary of the original 40 ft x 90 ft area to the north, to the southeast, and to the west was removed as part of this phase. The removal to the west was sufficient in extent to connect with the excavation of the West Pipe and the 10 ft x 30 ft area between the two pipes. Debris found during this phase was placed in the intermodals, except for two large concrete blocks, roughly 24"x24"x18", that were surveyed and found to be non-contaminated. These will be used to help backfill the remaining excavations at the end of the project. At the completion of this phase the site area was cleared to prepare for the termination survey. Figure 1-4 shows the areas of the site actually excavated to access the underground pipes and equipment as well as to remove contaminated soil. The grid developed by EA was also used in this figure to provide for a comparison between this figure and Figure 1-3. The difference is indicative of the increase in scope that occurred during removal of this contaminated soil and debris in this area.

## **2.0 Release Criteria**

Based on the work by EA<sup>3</sup>, cesium-137 is the only radionuclide expected to be present in significant quantities. It was the primary gamma emitting radionuclide found during their investigation. Cobalt-60 was only



 <b>FOSTER WHEELER ENVIRONMENTAL CORPORATION</b> <small>OAK RIDGE TITANIUM</small>			
<small>PROJECT NAME</small> <b>WESTWOOD RADIOACTIVE MATERIAL DISPOSAL FACILITY</b>			
<b>ABERDEEN PROVING GROUND, EDGEWOOD, MARYLAND</b> <b>ACTUAL AREAS REMEDIATED</b>			
SCALE:	DRAWING NUMBER:	FIGURE 1-4	SHEET OF REV
NONE			

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found in one sample (at 0.14 pCi/g) and naturally occurring radionuclides were found at ordinary environmental levels. Therefore, release criteria are only defined for cesium-137.

The release criteria for the site was established at 15 pCi/g cesium-137 based on Reference 2. Compliance with this limit is demonstrated by showing that the average concentration in each of the survey areas is less than 15 pCi/g, and that the maximum concentration in any sample is no higher than three times the average, or less than 45 pCi/g.

### **3.0 Termination Survey Plan**

The assessment of the final condition of the site is based on a revised termination survey plan. The original plan was included in the Site-Specific Work Plan...<sup>(5)</sup> Section 5.2.1, and consisted of sampling from the excavations and general soil sampling within the site boundary. The verification samples from the excavations were to be collected at a frequency of approximately one per 50 lineal feet for trenches and one per 2500 ft<sup>2</sup> for other areas. The general surface sampling was to be done by dividing the remaining portions of the site into grid squares, performing a walkover survey in each square, dividing the squares into "affected" and "unaffected" grid squares, and sampling the affected and unaffected grid squares using separate protocols consistent with Draft NUREG 5849<sup>(6)</sup>.

Background was to be determined by an exposure rate measurement and the analysis of a soil sample composite. The exposure rate measurement was to be the average of 10 independent off-site measurements. Samples of soil from these 10 locations were to be composited to make a single sample for analysis.

The walkover survey was to be done by walking over each grid area in a systematic way. However, this was modified by stopping every meter to make a six second measurement of gross count rate. This was done to reduce the errors from reading a ratemeter, and led to the collection of about 100 data points for each grid.

However, in the earliest part of the walkover survey it was discovered that all of the 49 survey units would have some readings in excess of twice background. This would have entailed the collection and analysis of four samples from each unit or a total of 196 samples. The analytical costs for this many samples were regarded as excessive since it was shown during the survey of the Adamsite Vault Area in the Bush River Area of Aberdeen Proving Ground that many of the samples taken in areas that were twice background contained cesium-137 concentrations much lower than 15 pCi/g.

A revised plan was prepared and approved by DSHE and ERRO that would require the collection of fewer samples and yet provide a high degree of assurance for deciding whether or not the site meets the release criteria.

#### **3.1 The Revised Termination Survey Plan**

The revised plan included most of the elements of the original plan, e.g., biased sampling of trenches and other special areas, the determination of background, and performance of a walkover survey. It differed in the collection and analysis of soil samples from site surfaces, and the surfaces of the major excavation. The number of samples collected were considerably fewer and the methodology for their selection and analysis was different. Samples collected from the surface of the site and from surfaces of the major excavation (the 40 ft x 90 ft area and adjacent contaminated areas that had to be included) were taken as part of a statistical survey at the end of operations.

For the statistical survey there were four survey areas considered instead of "affected" and "unaffected" areas. The four zones were the excavated area, unexcavated areas north of the marsh, the marsh area, and subsurface areas north of the marsh that were potentially backfilled. These areas were selected because the probability of finding residual contamination in each of them was different. The excavated area had the highest probability since that area was recognized as contaminated, and scheduled for remediation. The unexcavated area north of the headwall was found to be sufficiently free of contamination as to not require remediation. Almost no trace of contamination was found during operations in the marsh area away from the immediate vicinity of the headwall, so this area was regarded as the least likely to be contaminated. The different potential for contamination of subsurface soils occurs because of the historic backfill operations associated with earlier remediation activities.

### 3.2 Basis

The sample design for the statistical samples is based on the use of the Sign Test to test an hypothesis about the average of each survey area. The 95% significance level was selected to limit the Type I error to 5%. The hypothesis tested is the following: The median concentration of the residual cesium-137 in the survey area is not less than 15 pCi/g.

The test statistic consists of a number of "+s" and "-s" that are determined by subtracting the concentration in pCi/g found in each of "N" samples from 15 and recording the sign (+ or -) of the result. The number of plus signs is then compared with number of those expected, i.e., N/2, using a normal or binomial distribution with a mean of N/2 and a standard deviation of  $0.5(N \exp 0.5)$ . At a 95% significance level the critical number of "+s" is calculated from the "Z score" as follows:

$$Z = 1.645 = ((\text{Critical number of "+s"} - N/2) / (0.5)N \exp 0.5) \quad (1)$$

If the actual number of "+s" exceeds the critical number calculated from the above equation, the hypothesis is rejected. For example, if the number of samples were 16, the critical number of "+s" would be 12.29, and therefore 13 or more "+s" would cause the hypothesis to be rejected. Rejection assures that the median concentration in the survey area is less than 15pCi/g.

The median of the samples taken during the walkover survey in each of the surface regions have been compared to the averages and found to be in substantial agreement.

Table 3-1. Central Tendencies for Count Rates		
Name of Area	Median*	Mean*
Excavation	14.3	15.4
North unexcavated	4.1	5
Marsh	2.9	3.2
Subsurface	No data	No data

\* counts per 0.1 minutes

It follows then that if the median is less than 15 pCi/g, the mean will be also and the site will meet the release criteria.

### 3.3 Number of samples

The number of samples was determined by balancing the power of the test (enhanced by having a larger numbers of samples) against the costs (which are proportional to the number of samples). The minimum number of samples which can be used with the Sign Test and achieve a significance level of 95% or greater is six (using the normal approximation to the binomial distribution shown in Equation (1)) or five (using the binomial distribution directly).

The actual numbers of samples selected are the following:

Excavated Area	16
North Unexcavated Area	12
Marsh Area	6
Subsurface Area	12.

Larger numbers were selected for areas depending on (1) the probability of finding contamination there in light of operating experience, and (2) the desired test power.

To determine the power of the test it was necessary to have an estimate of the variation in the population. To estimate this the concentrations measured on 52 soil samples taken during operations on soil in excavation areas that were not subsequently remediated were used. The standard deviation was found to be 3.36 pCi/g. The value of this parameter was assumed to apply for all four regions. It was then used to compute the Type II error, i.e., the chance of concluding that the site did not meet the criteria when in fact the average concentration was 10.0 pCi/g.

Type II errors for this case are given as follows:

Excavation Area	p = 0.0202
North Unexcavated Area	p = 0.0436
Marsh Area	p = 0.3450
Subsurface Area	p = 0.0436

Therefore there is less than a 5% chance of concluding erroneously that the site does not meet release criteria when in fact the average was 10 (and it did meet criteria) - except for the marsh area. The higher allowable Type II error was considered acceptable since sampling and measurements during operations did not indicate any significant radioactivity there. Hence, the actual sample standard deviation for the marsh area should be much lower than assumed.

### 3.4 Acceptance Criteria

For the number of samples selected the hypotheses for the four areas will be rejected - and the site considered to meet the release criteria - if the following is found to be true:

Excavation Area	13 or more of 16 are <15pCi/g	p = 0.013*
North Unexcavated Area	10 or more of 12 are <15pCi/g	p = 0.022*
Marsh Area	6 of 6 are <15 pCi/g	p = 0.016*
Subsurface Area	10 or more of 12 are <15 pCi/g	p = 0.022*

\*Type I error, i.e., the probability of accepting a region with an average >15 pCi/g

### 3.5 Location of Samples

The samples will be taken on a triangular grid having the number of nodes equal to the number of samples. The node spacing is determined by dividing the area considered, e.g., excavated area, by the number of samples. 1.52 times the square root of this area gives the node spacing (based on the area being an equilateral triangle). Using this relationship, the node spacings for the four areas were determined.

Name of Area	Area (square meters)	Node spacing (m)
Excavation	700	10.1
North unexcavated	4140	28.2
Marsh	750	17
Subsurface	3200	24.8

The location of the first node was determined beginning at the northwest corner of the region and proceeding east 60% of the node spacing, and then proceeding 72% of the node spacing south. 60 and 72 were selected from a random number table.

### 4.0 Termination Survey Results

Termination survey results can be divided into three categories, a background sample, field measurements taken during the walkover survey, and the analyses of three groups of soil samples. The three groups of soil samples consist of samples taken from trenches at the conclusion of excavation there, statistical survey samples, and samples of excavated soil reserved for backfill. Figure 4-1 is a drawing of the site showing the locations of the samples taken from trenches and for the statistical survey. This figure is a "C" sized drawing and is folded into a pocket at the back of this report. Two additional samples were taken from the surface soil and split with the NRC. Figure 4-1 also shows the locations of these two samples.

Samples of the excavated soil reserved for backfill were taken from the filled roll-off boxes or in one case from a soil pile.

#### 4.1 Background

The average background count specific to the energy near the 0.662 MeV gamma ray from cesium-137 found using the portable 2"x2" NaI detector was 26 cpm. The analysis of the soil samples composited to represent the soils in the area which were not contaminated by work at the WRMDF was found to be  $0.5 \pm 0.1$  pCi/g. Since this value is less than five percent of the release limit of 15 pCi/g, the presence of cesium-137 in background can be neglected.

## 4.2 Results of Special Samples

Soil samples were taken after excavation of each of the trenches and the area next to the headwall that are separate from the statistical survey done later. These samples were analyzed on-site using the 3"x3" NaI crystal and multichannel analyzer. In addition some of the samples were analyzed by an Lockheed Analytical Services (LAS). Appendix 4 quantifies the relationship between the on-site and LAS analyses.

### 4.2.1 Extreme West Pipe

Three soil samples were taken from the trench after completing the excavation of the Extreme West Pipe. The results of the analyses by LAS are given in Table 4-1.

Table 4-1. Cesium-137 in Soil Concentrations in Extreme West Excavation		
Sample Identification	Activity (pCi/g) On-Site Analysis	Activity (pCi/g) Off-site Analysis
12-SS-01-06	4.40	5.89
12-SS-02-06	<0.14	0.105
12-SS-03-06	<0.12	0.254

### 4.2.2 West Pipe

Six samples were taken after completing the excavation of the West Pipe and the Septic Tank. The results of the analysis of these samples using the on-site 3"x3" NaI detector and MCA are given in Table 4.2. Note that Sample C-06 was taken under the Septic Tank after the tank was removed.

Table 4-2. Cesium-137 in Soil Concentrations in Excavation of West Pipe			
Sample Identification	Activity (pCi/g)	Sample Identification	Activity (pCi/g)
C-01	<0.17	C-05	<0.54
C-02	<0.17	C-06	<0.15
C-03	<0.15	12-SS-07-06	0.057
C-04	<0.15		

Note: Sample #12-SS-07-06 is a QA/QC check equivalent to Sample # C-06

### 4.2.3 East Pipe South of the Headwall

Three samples were taken in the excavation after the removal of the steel portion of the East Pipe (that part which was south of the headwall). The samples were analyzed both on-site and by LAS. The results of these analyses are given in Table 4-3.

Table 4-3. Cesium-137 in Soil Concentrations in Excavation of East Pipe South of the Headwall		
Sample Identification	Activity (pCi/g) On-Site Analysis	Activity (pCi/g) Off-site Analysis
12-SS-04-06	<0.49	1.08
12-SS-05-06	<0.18	0.255
12-SS-06-06	<0.13	0.280

#### 4.2.4 Area of Headwall

The headwall and adjacent soil was removed leaving an excavation about 12 feet in diameter and seven feet deep - all under water. Samples were taken from soil at the edges of the excavation in the ESE and SSE directions from the headwall (where the greatest contamination was seen) at depths of 0 ft to 2 ft and from 2 ft to 4 ft. In addition samples of soil were taken using the backhoe as the last three buckets of soil were removed from the excavation. The results of these analyses are given in Table 4-4. Samples E-43 and E-44 are from 0 ft to 2 ft and from 2 ft to 4 ft in the ESE direction, and samples E-45 and E-46 are from the same range of depths, but taken in the SSE direction. Samples E-47, E-48, and E-49 were taken from the backhoe bucket.

Figure 4-4. Cesium-137 in Soil Concentrations in Excavation at the Headwall			
Sample Identification	Activity (pCi/g)	Sample Identification	Activity (pCi/g)
E-43	<0.11	E-47*	1.21
E-44	<0.11	E-48	0.97
E-45	0.21	E-48*	0.87
E-46	26.4	E-49	2.67
E-47	1.4	E-49*	3.29

\* Analysis by LAS

#### 4.2.5 East Pipe North of Headwall

Five samples were taken from the trench after removal of the East Pipe north of the headwall and as much soil as necessary to meet release requirements. On-site analyses were done using the 3"x3" NaI detector and MCA. The results are shown in Table 4-5. Samples E-52, E-53, E-54, E-55, and E-63 were taken from the bottom of the trench 15 ft, 40ft, 70 ft, 90 ft, and 110 ft north of the headwall respectively. Two of the samples were

also analyzed by LAS, 12-SS-08-06 was a QA/QC check corresponding to E-52 and 12-SS-09-06 is a check corresponding to E-53.

Table 4-5. Cesium-137 in Soil Concentrations in Excavation of East Pipe North of the Headwall			
Sample Identification	Activity (pCi/g)	Sample Identification	Activity (pCi/g)
E-52	1.50	E-63	<0.11
E-53	6.59	12-SS-08-06	1.54
E-54	<0.10	12-SS-09-06	8.37
E-55	<0.10		

### 4.3 Walkover Survey Results

The results of the walkover survey are given in Table 4-6. The Grid ID refers to the alphanumeric notation used in Figure 4-1. For example "23EF" refers to the 10 meter square bounded by lines "2", "3", "E", and "F". Approximately 100 individual measurements were made in units of counts per minute (CPM) and corrected to gamma flux density ( $\gamma/cm^2sec$ ) as shown in Appendix 3. The results are summarized by presenting the maximum, median, and mean value for the flux densities in each measurement grid. For comparison, one cesium-137 gamma per square centimeter per second is equivalent to an exposure rate of 1.28  $\mu R/hr$ .

Table 4-6. Walkover Survey Summary

Grid ID	Gamma Flux Density ( $\gamma/\text{cm}^2 \text{ sec}$ )			Grid ID	Gamma Flux Density ( $\gamma/\text{cm}^2 \text{ sec}$ )		
	Maximum	Median	Mean		Maximum	Median	Mean
12AB	0.332	*	0.0197	45BC	0.643	0.133	0.139
12BC	0.228	*	*	45CD	0.643	0.116	0.127
12CD	0.176	*	*	45DE	0.540	0.125	0.135
12DE	0.643	0.0726	0.0970	45EF	1.01	0.115	0.154
12EF	0.488	0.0986	0.120	45FG	1.11	0.436	0.441
12FG	1.53	0.231	0.282	45GH	1.84	0.284	0.332
12GH	0.903	0.247	0.271	45HI	0.851	0.171	0.248
12HI	0.332	0.0576	0.0701	56AC	0.799	*	*
23AB	0.332	0.0208	0.0415	56CD	0.280	*	*
23BC	0.228	*	*	56DE	0.228	*	0.0166
23CD	0.280	*	*	56EF	0.540	0.138	0.177
23DE	0.540	*	*	56FG	0.851	0.0882	0.161
23EF	1.68	0.244	0.306	57GH	0.280	0.0093	0.0161
23FG	1.53	0.415	0.457	67CE	0.851	0.0047	0.0353
23GH	1.47	0.471	0.524	67EF	0.448	0.120	0.120
23HI	0.592	0.132	0.150	67FG	0.799	0.0156	0.0420
34AB	0.332	0.0208	0.0265	78EG	0.540	0.0296	0.0519
34BC	0.332	0.0135	0.0311	910EF	0.627	0.0617	0.0690
34CD	0.747	0.0467	0.0893	910FG	0.332	0.0166	0.0322
34DE	0.851	0.239	0.284	1011EF	0.280	0.0337	0.0457
34EF	1.42	0.704	0.724	1011FG	0.228	0.0498	0.0815
34FG	1.99	0.588	0.575	1112EF	0.176	0.0208	0.0223
34GH	1.47	0.473	0.526	1122FG	0.280	*	0.0104
34HI	0.851	0.357	0.368	1213FG	0.627	0.0259	0.0415
45AB	0.436	0.0384	0.0503				

\* Value below background

#### 4.4 Statistical Survey of the Excavated Area

Table 4-7 gives the results of the analysis of the 16 samples taken at random from the excavated area which comprise the first of four statistical surveys.

Table 4-7. Cesium-137 in Soil Concentrations from the Statistical Survey of the Excavated Area					
Sample #	Activity pCi/g	Sample #	Activity pCi/g	Sample #	Activity pCi/g
12-PVSS-X01	1.3	12-PVSS-X07	6.2	12-PVSS-X13	1.3
12-PVSS-X02	4.6	12-PVSS-X08	4.8	12-PVSS-X14	0.3
12-PVSS-X03	7.0	12-PVSS-X09	6.7	12-PVSS-X15	2.4
12-PVSS-X04	6.4	12-PVSS-X10	4.4	12-PVSS-X16	3.6
12-PVSS-X05	1.8	12-PVSS-X11	3.0	12-PVSS-X17	9.8
12-PVSS-X06	4.0	12-PVSS-X12	4.2	12-PVSS-X18	3.8

Note: Sample No. 12-PVSS-X17 is a QA/QC sample equivalent to No. 12-PVSS-X03, and Sample No. 12-PVSS-X18 is a QA/QC sample equivalent to Sample No. 12-PVSS-X06.

#### 4.5 Statistical Survey of the Unexcavated Area North of the Marsh

Table 4-8 contains the results of the analysis of the 12 surface samples taken at random outside of the excavated area, but north of the headwall. The results comprise the second in the series of statistical surveys.

Table 4-8. Cesium-137 in Soil Concentrations from the Statistical Survey of the Unexcavated Area					
Sample #	Activity pCi/g	Sample #	Activity pCi/g	Sample #	Activity pCi/g
12-PVSS-U01	<0.2	12-PVSS-U06	1.1	12-PVSS-U11	0.9
12-PVSS-U02	0.13	12-PVSS-U07	0.4	12-PVSS-U12	0.3
12-PVSS-U03	1.1	12-PVSS-U08	1.0	12-PVSS-U13	1.3
12-PVSS-U04	1.2	12-PVSS-U09	1.2		
12-PVSS-U05	<0.1	12-PVSS-U10	1.7		

Note: Sample No. 12-PVSS-U13 is a QA/QC sample equivalent to Sample No. 12-PVSS-U06. Sample Numbers 12-PVSS-U06 and 12-PVSS-U08 were split with the NRC.

#### 4.6 Statistical Survey of the Marsh Area

Table 4-9 shows the results of the analysis of the six random samples taken from the surface of the marsh area south of the headwall. The results comprise the third statistical survey.

Table 4-9. Cesium-137 in Soil Concentrations from the Statistical Survey of the Marsh Area					
Sample #	Activity pCi/g	Sample #	Activity pCi/g	Sample #	Activity pCi/g
12-PVSS-M01	<0.2	12-PVSS-M04	<0.2	12PVSS-M07	0.14
12-PVSS-M02	<0.2	12-PVSS-M05	<0.1		
12-PVSS-M03	0.2	12-PVSS-M06	<0.1		

Note: Sample No. 12-PVSS-M07 is a QA/QC sample equivalent to Sample No. 12-PVSS-M01.

#### 4.7 Statistical Survey of the Subsurface Area

Table 4-10 shows the results of the analysis of the 12 subsurface soil samples taken randomly north of the treeline. This is the area where material is believed to have been backfilled during previous remediation of the WRMDF.

Table 4-10. Cs-137 in Subsurface Soil from the Statistical Survey of the Area North of the Treeline					
Sample #	Activity (pCi/g)	Sample #	Activity (pCi/g)	Sample #	Activity (pCi/g)
12-PVSS-S01	<0.1	12-PVSS-S06	0.2	12-PVSS-S11	<0.1
12-PVSS-S02	<0.1	12-PVSS-S07	5.8	12-PVSS-S12	<0.1
12-PVSS-S03	<0.1	12-PVSS-S08	<0.1	12-PVSS-S13	<0.1
12-PVSS-S04	<0.1	12-PVSS-S09	<0.1		
12-PVSS-S05	<0.1	12-PVSS-S10	<0.1		

Note: Sample No. 12-PVSS-S13 is a QA/QC sample equivalent to Sample No. 12-PVSS-S09.

#### 4.8 Excavated Material Reserved for Backfill

Table 4-11 gives the results of samples taken from the roll-off boxes and one soil pile where soil was staged for reuse as fill. Soil was placed in the pile or the roll-off boxes when field measurements indicated that it would meet the radiological release criteria for the site. One composite sample was taken from the soil pile and from each box to confirm the field determinations.

Table 4-11. Concentrations in Soil Set Aside for Reuse as Fill			
Sample Identification	Activity (pCi/g)	Sample Identification	Activity (pCi/g)
12-BF-08-96/01	0.27	12-BF-25-39/01	12.4
12-BF-07-84/01	0.52	12-BF-29-104/01	9.8
12-BF-13-18/01	0.32	12-BF-28-21/01	0.3
12-BF-14-116/01	0.75	12-BF-27-25/01	3.5
12-BF-16-57/01	3.3	12-BF-12-12/01	2.5
12-BF-13-15/01	1.3	12-BF-14-SP	1.7
12-BF-15-70/01	8.2		

#### 4.9 Other Radionuclides

Table 4-12 summarizes the concentrations of the gamma emitting radionuclides found in the samples taken as part of the statistical portions of the termination survey as well as samples of soil set aside for backfill. No detectable concentrations of cobalt-57, cobalt-60, cesium-137, thorium-234, or uranium-235 were not found in any of the samples.

Table 4-12. Concentrations of Other Radionuclides in Site Soil					
Radionuclide	Frequency of Detection	Concentration (pCi/g)			Concentration in Background (pCi/g)
		Maximum	Median	Mean	
Ac-228	59	1.4	0.81	0.85	0.80±0.4
Bi-212	3	1.5	1.4	1.3	<4.7
Bi-214	60	1.6	0.63	0.69	0.85±0.3
K-40	60	16	5.95	6.77	5.45±1.9
Pb-210	3	4.3	3.7	3.8	<4.6
Pb-212	60	1.8	0.83	0.93	0.85±0.2
Pb-214	60	1.8	0.72	0.73	0.80±0.3
Ra-226	60	1.6	0.64	0.71	0.85±0.3
Tl-208	60	0.5	0.29	0.30	0.28±0.10

## **5.0 Discussion of Results**

The significance of each set of results presented in Section 4 is discussed separately in the following paragraphs.

### **5.1 Extreme West Pipe**

The results of the samples taken of the trench after removal of the Extreme West Pipe meet the release criteria. The only significant contamination found during field measurements was by the discharge, and this is the location of the soil still containing notable cesium-137, i.e., 5.89 pCi/g. Field measurements showed nothing above background along the remainder of the excavation, and this is reflected in the very low concentrations of cesium-137 seen in 12-SS-02-06 and 12-SS-03-06.

### **5.2 West Pipe**

Concentrations of cesium-137 during excavation of the West Pipe were all below the detection level of the on-site 3"x3" NaI detector and MCA (using a 30 minute count time). This is consistent with the field measurements which showed nothing in the trench around the terra cotta line or the septic tank.

Some contamination was found near the soil surface north and mostly east of sample point C-04. This was eventually found to be associated with the 40 ft by 90 ft contaminated area and the two were excavated as a single unit. The effectiveness of the clean-up of this area apart from the trench is addressed in Section 5.7.

### **5.3 East Pipe South of the Headwall**

No significant concentration of contamination was seen anywhere in the marsh area except in the area of the headwall. This includes the area near the final discharge point. Field measurements and sample analyses alike confirmed the absence of contamination in this area.

### **5.4 Area of Headwall**

The area surrounding the headwall is the area where the highest concentrations were found, first by the EA study, and later in the preliminary site evaluation by Foster Wheeler. Apparently, material was discharged at the headwall before the steel line was installed extending the discharge point to a location across the marsh. It was found that the extent of the dispersion of contamination during that early period was greater in the SSE and ESE directions, generally upstream. This suggests that during rainy weather contamination was caught in the backwaters of the Reardon Inlet and never completely washed out to the bay. This left a mixture of contaminated residue, leaves and other debris which subsequently was covered with silt.

During excavation the analysis of in-process samples showed a decreasing trend in the concentration of cesium-137 in the sediments with depth and distance from the headwall, with occasional high samples. These higher concentrations were believed to have resulted from subsidence of the SE side of the excavation which added soil from these former backwater deposits to the excavation.

Excavation was continued until concentrations in the material removed (from underwater) were reduced to values well below the release criteria. This is reflected in samples E-47, E-48, and E-49 taken from the bucket at the conclusion of the excavation of the headwall area.

Samples E-43, E-44, E-45, and E-46 were taken to assess the amount of contamination that remained in the backwater area. Contamination was found, i.e., 26.4 pCi/g cesium-137 in sample E-46, but at a depth of more than two feet, and representing only a limited area.

The headwall area is still regarded as meeting the release criteria because this one high sample is not more than three times the limit of 15 pCi/g, and the contaminated material is covered with at least two feet of soil. Furthermore, a computer code for analyzing the dose via various environmental pathways, RESRAD, was used to evaluate this condition. The analysis showed that the total effective dose equivalent (TEDE) from cesium-137 (using default values) is 27 times lower when the cesium-137 has a two foot thick clean cover. For comparison, a cesium-137 concentration of 405 pCi/g in subsurface soil below a depth of two feet would be required to give the same TEDE as the TEDE from soil uniformly contaminated with 15 pCi/g cesium-137 all the way to the surface.

### **5.5 East Pipe North of Headwall**

The five samples taken at the bottom of the excavation of the East Pipe north of the Headwall were all well below the release criteria. Contamination had been found below the pipe at several of the terra cotta joints. This only was excavated to meet the 15 pCi/g limit, and explains the 8.37 pCi/g residual. Agreement between the two samples analyzed both on-site and by LAS is regarded as good, considering that the samples were analyzed wet on-site, and dry by LAS.

### **5.6 Walkover Survey**

The walkover survey was done chiefly to learn if there were any significant hot spots that were missed by the random surveys. Some places were found where isolated counts exceeded the new field limit of 238 CPM (238 CPM converts to  $1.08\gamma/\text{cm}^2\text{sec}$ ). However, these were limited in extent, i.e., no more than 16 m<sup>2</sup> in area. Furthermore, in excavations the field limit becomes conservative, since more gamma rays reach the detector per unit of soil contamination in an excavation than if the soil surface were flat. This is illustrated in grid "34EF". The highest average flux density was found there, but three samples from that grid contained only 4.6, 7.0, and 6.7 pCi/g cesium-137.

The median and average flux densities for all of the grids were below, and often well below, the flux density corresponding to 238 CPM despite the conservatism caused when a field measurement is taken in an excavation.

### **5.7 Statistical Survey of the Excavated Area**

The concentrations of cesium-137 in all 16 samples which comprised the statistical survey of the Excavated Area were less than 15 pCi/g. This causes one to reject the hypothesis that the median cesium-137 concentration (and therefore the average) is not less than 15 pCi/g. It follows that the average is actually less than 15 pCi/g and the excavated area meets the site release criteria.

### **5.8 Statistical Survey of the Area North of the Marsh**

The concentrations of cesium-137 in all 12 samples which comprised the statistical survey of the unexcavated area north of the headwall were less than 15 pCi/g. This causes one to reject the hypothesis that the median cesium-137 concentration (and therefore the average) is not less than 15 pCi/g. It follows that the average is actually less than 15 pCi/g and the unexcavated area north of the headwall meets the site release criteria.

Note that not only are the concentrations less than 15 pCi/g but all but one is lower by a factor of ten. That one is lower by a factor of more than eight. Based on these results one could also conclude statistically that the average cesium-137 concentration in this soil is less than 1.5 pCi/g.

### **5.9 Statistical Survey of the Marsh Area**

The concentrations of cesium-137 in all six samples which comprised the statistical survey of the Marsh Area were less than 15 pCi/g. This causes one to reject the hypothesis that the median cesium-137 concentration (and therefore the average) is not less than 15 pCi/g. It follows that the average is actually less than 15 pCi/g and the excavated area meets the site release criteria.

Note that not only are the six concentrations measured less than 15 pCi/g but they are all lower by more than a factor of more than 50. Based on these results one could also conclude statistically that the average cesium-137 concentration in this soil is less than 0.3 pCi/g.

### **5.10 Statistical Survey of the Subsurface Area**

The concentrations of cesium-137 in all 12 samples which comprised the statistical survey of the subsurface area were less than 15 pCi/g. This causes one to reject the hypothesis that the median cesium-137 concentration (and therefore the average) is not less than 15 pCi/g. It follows that the average is actually less than 15 pCi/g and the subsurface area north of the tree line meets the site release criteria.

The absence of significant contamination in the subsurface soil indicates that there are no major regions at the WRMDF that had been backfilled in the past that haven't been remediated as part of this project. The sample 12-PVSS-S07 containing 5.8 pCi/g was from the excavated area and shows that there is a contaminated residual. However, the concentration found meets the release criteria and does not suggest that there are still higher concentrations at greater depths.

### **5.11 Excavated material Reserved for Backfill**

The analysis of samples taken from each of the roll-off containers verifies that the soil staged there is suitable (from a radiological standpoint) for reuse as backfill on the site. This confirms the results of field measurements made when an area was to be excavated, or of the excavated soil in the backhoe bucket awaiting disposition. Only in cases when the field measurements showed that the field limit was not exceeded was the soil placed in a roll-off container. For this reason one would expect that all of the samples taken from the roll-off containers would meet the release criteria as they did.

### **5.12 Other Radionuclides**

Samples taken as part of the four statistical surveys and from the roll-offs were analyzed using gamma spectrometry. As a result, the concentrations of other gamma emitting radionuclides were determined along with the concentration of cesium-137 in soil. The concentrations of the gamma emitting radionuclides detected in these samples are summarized in Table 4-12. Only naturally occurring radionuclides were found, at typical background concentrations. This confirms the assessment made by EA<sup>3</sup> and the decision not to consider these materials in the site remediation and release process.

## **6.0 Conclusions**

Based on the results of the termination survey, it is concluded that the WRMDF site meets the criteria for the release from radiological controls, and for the deletion of that site as a contaminated area from the U.S. Nuclear Regulatory Commission License #19-10306-01(20).

This is a reasonable assertion since only one of the over 80 samples taken as part of the survey had a concentration exceeding 15 pCi/g cesium-137 and because that concentration did not exceed 45 pCi/g. In addition, the statistical surveys of the four soil populations showed that the average concentration of cesium-137 in these areas was substantially less than 15pCi/g. Finally, the walkover survey showed that the average count rate in each 100 m<sup>2</sup> of the site was less than the field limit associated with the limiting cesium-137 concentration of 15 pCi/g.

## **7.0 References**

1. Field Sampling and Analysis for the Westwood Study Area, Draft Sampling Report - Cluster 6, Jacobs Engineering Group, Inc., September 1994.
2. Action Plan to Ensure Timely Remediation of sites Listed in the Site Decommissioning Management Plan, USNRC, SECY-92-106, March 24, 1992.
3. Scope of Removal Action (RA) Activities for Westwood Radioactive Material Disposal Facility at Edgewood Area Aberdeen Proving Ground, Maryland, EA Engineering, Science and Technology and KCI Technologies, December 1995.
4. Site Evaluation for Removal Action for Westwood Radioactive Materials Disposal Facility, Foster Wheeler Environmental Corporation, December 1996.
5. Site-Specific Work Plan for the Westwood Radioactive Materials Disposal Facility, Foster Wheeler Environmental Corporation, July 1996.
6. Berger, J.D. Manual for conducting Radiological Surveys in Support of License Termination, Environmental Site Assessment Program, Energy/Environmental Systems Division, Oak Ridge Associated Universities, NUREG/CR-5849, June 1992.

Appendix I  
FIELD SCREENING PROTOCOL  
for the Remediation of the  
Westwood Radioactive Material Disposal Facility

Introduction

Ten pairs of measurements were made to establish a relationship that can be used in the field to decide when remediation goals have been achieved. Each pair consists of a direct measurement made 6" above the soil surface and the analysis of a soil sample taken at that location.

The direct measurement was made using a 2" by 2" NaI detector and a Ludlum Model #2221 rate meter/scaler operating in the single channel analysis mode. The meter high voltage, threshold, and window were set to optimize the signal received from cesium-137 gamma rays. The instrument settings and the instrument responses to both background and a standard source established during these measurements are to be maintained throughout the life of the project.

The soil samples were collected and shipped to the off-site laboratory for gamma isotopic analysis. Each result was quoted as a unit of activity per unit of dry weight, e.g., pCi/g.

Results

Table 1 gives the results of the ten pairs of measurements. A linear regression equation derived for this data set was found to be the following:

$$y = 0.0342(x) - 5.27$$

Here "y" is the activity in the soil in pCi/g and "x" is the net counts per minute (NCPM) of the corresponding field measurement.

Figure 1 is the graphical representation of the experimental results and the corresponding linear regression line.

Discussion of Results

The strength of the linear regression analysis can be evaluated based on the determination of the correlation coefficient and the ability of the relationship to predict the activities for other samples.

The correlation coefficient was found to be  $r = 0.906$ . Since this value is close to 1.0 the field measurement "x" (in NCPM) is a reliable indicator of the actual activity of the soil "y" (in pCi/g).

A second check on the strength of this set of data was made by using the linear regression equation to calculate the expected results for 10 other pairs of measurements made in the same way. These measurements were made to confirm the choice of the site boundary. The field measurement values were inserted as "x" values

in the regression equation and the "y" values calculated. These expected concentrations were then compared with the concentrations determined by the off-site laboratory. Table 2 shows this comparison. Except for sample BC-07 there is a consistent relationship between the two sets of data. The BC-07 anomaly may be due to substantial local variations in the cesium-137 concentration such that the sample was taken from a cleaner portion of soil.

### Conclusion

A usable field limit was developed from the linear regression equation by multiplying the release limit, 15 pCi/g, by 0.9, to be conservative, and substituting this value for "y". The value of "x" determined this way was found to be 549 NCPM. Consequently, a field measurement larger than this indicates that the soil needs to be removed and managed as radioactive waste. A field measurement lower than 549 NCPM indicates that the soil meets the criteria for site release. Therefore, that soil does not have to be excavated, or if already excavated, that soil can be used for fill.

It is important to note that a field measurement is only regarded as an indicator and is to be confirmed by both on-site gamma spectrometry, and gamma spectrometry by an off-site laboratory. This confirmation requirement must be met before Foster Wheeler is ready to conclude that the soil remaining on site meets the release criteria of 15 pCi cesium-137/gram.

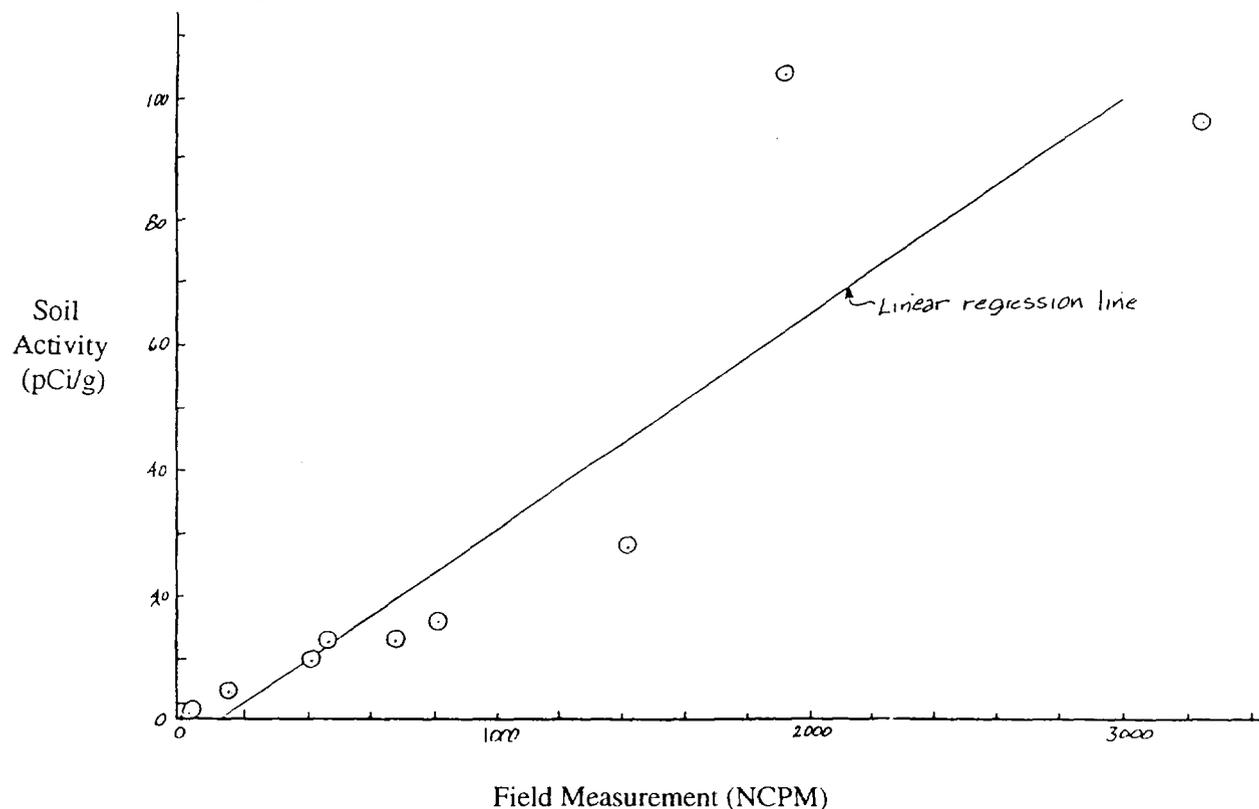


Figure A-I-1. Supporting Data for the Field Screening Protocol

## Appendix II

### ESTABLISHMENT OF REVISED FIELD LIMIT

An instrument change was made on October 15 when the calibration on the LM 2221 ratemeter/single channel analyzer and 2"x2" NaI crystal field detector system expired (Serial Number 97799). That was the instrument that had been used to establish the Field Screening Protocol. The single channel analyzer settings on the replacement instrument had been set by the instrument supplier, whereas the settings for the original instrument was established in the field at the time when the Field Screening Protocol was established. Since the instruments were set differently, the efficiencies would be different, and the field limit would have to be revised.

The revised (new) field limit was developed by counting previous samples having a range of concentrations in overturned marinelli beakers, first with the original instrument and then with the replacement instrument. Table AII-1 lists the results and the ratio between the NCPMs for the two detector systems. The average of these ratios (2.49) was used to calculate the new field limit, changing the limiting NCPM from 548 to 220 and the limiting CPM from 646 to 238.

Table A-II-2. Measurements for Establishing the Revised Field Limit			
Sample Number	Net Count Rate (NCPM)		Ratio of NCPM
	Protocol Settings*	Special Calibration Settings**	
E-5	7130	3107	2.29
E-12	595	223	2.67
E-41	42	19	2.21
E-01	45	12	3.75
E-29	232	100	2.32
E-9	5617	2433	2.31
E-35	109	46	2.37
E-10	1775	767	2.31
E-14	1827	805	2.27
E-04	811	332	2.44

### Appendix III

#### CALCULATION OF GAMMA FLUX DENSITY

Field measurements were made with the 2"x2" NaI crystal held six inches above the surface of the soil. Converting the instrument reading (CPM) to pCi/g was done on a level appropriate for screening, but not appropriate for documentation. This is because the actual activity in soil that gives a certain CPM depends on the distribution of the contamination in the soil (both radially, and with depth, and well as any deviation between the actual shape of the soil surface from a flat surface.

Therefore, a conversion was made to change the count rate to the gamma flux density, i.e., the number of gamma rays having an energy of approximately 0.662 MeV per square centimeter per second present at the location of the detector. This conversion required the determination of the efficiency of the detector and the effective area of the detector. The development of the conversion follows.

#### Instrument efficiency:

0.24 $\mu$ Ci Cs-137 standard source on 4/11/95	
factor to decay to 1/11/98	0.939
factor to accommodate branching ratio	0.85
factor considering $2\pi$ geometry	0.5
gammas/sec = $.24(.939)(.85)(.5)(3.7E4)$	3.54E3
Average net count rate for standard source	8.1E3 CPM
Instrument efficiency $(81E3)/(3.54E3)(60)$	3.81E-2

#### Detector area

Assume the effective area of the detector is the area of a hemisphere having the same volume as the crystal.

Volume of crystal	$\pi(1)(1)(2) \text{ in}^3$	$= 2\pi \text{ in}^3$
radius of equivalent hemisphere	$(1/2)(4/3)\pi r^3 = 2\pi$	$r = 1.44 \text{ in}$
Area of hemisphere	$2\pi r^2 = 13.1 \text{ in}^2$ or $6.45(13.1)$	$= 84.3 \text{ cm}^2$

#### Conversion factor (CPM to $\gamma/\text{cm}^2\text{sec}$ )

$$\text{NCPM} = \text{CPM} - \text{Background CPM}$$

$$\gamma/\text{cm}^2\text{sec} = \text{NCPM}/(0.00381)(60)(84.3) = \text{NCPM}(5.19E-3)$$

## Appendix IV

### DUPLICATE SAMPLE COMPARISONS

To assure consistency between analyses done for the termination survey by LAS Laboratories, Barringer Laboratories, and certain on-site analyses the decision was made to analyze a number of duplicate samples. Comparable samples from an area or soil container were analyzed both on-site using the 3"x3" NaI detector and Multichannel Analyzer and by one of the off-site laboratories. There was one inherent difference between the analyses, however, the on-site analyses were made wet whereas the off-site analyses were made after evaporating the moisture in the sample. Tables AIV-1 and 2 show the results of these analyses. Table AIV-1 compares results of on-site analyses with those of LAS Laboratories. Table A-IV-2 compares the on-site results with those of Barringer Laboratories. Samples that were below detection limits for both analyses were not included in the tables. Despite the difference caused by the presence of moisture in the on-site samples there was good agreement. To confirm this linear regression equations and correlation coefficients were calculated (one outlying point in each data set was not included in the analyses). The results shown as follows do confirm this fact.

Linear regression equation for the LAS Laboratories - on-site comparison

$$\text{Concentration (LAS)} = 1.0749(\text{Concentration (on-site)}) + 1.227$$

Correlation coefficient for LAS Laboratories - on-site comparison

$$r^2 = 0.9121$$

Linear regression equation for the Barringer Laboratories - on-site comparison

$$\text{Concentration (Barringer)} = 1.0045 (\text{Concentration(on-site)}) + 0.542$$

Correlation coefficient for the Barringer Laboratories - on-site comparison

$$r^2 = 0.9616$$

Table A-IV-1. Duplicate Sample Comparisons for LAS Laboratories and On-site Analyses					
Sample Number	Activity (pCi/g)		Sample Number	Activity (pCi/g)	
	LAS	On-site		LAS	On-site
12-SS-01-06	5.89	4.44	12-WS-07...	9.10	6.7
-02-06	0.105	<0.14	-08	9.03	6.3
-03-06	0.254	<0.12	-09	14.1	9.7
-04-06	1.08	<0.58	-10	13.3	9.74
-05-05	0.26	<0.13	-11	9.07	8.60
06-06	0.28	0.15	-13	5.79	4.21
-07-06	0.06	0.15	-14	10.2	9.75
E-19	8.48	7.50	-15	15.2	14.6
E-36	0.13	<0.02	-16	13.5	11.0
E-37	0.15	<0.08	-17	26.3	18.5
E-47	1.21	1.40	-18	26.9	19.4
E-48	0.87	0.97	-19	19.4	15.8
E-49	3.29	2.67	-20	30.9	22.6
E-56	2.50	1.90	-21	19.6	22.7
E-57	16.9	13.6	-22	44.3	33.9
12-WS-01...	4.25	2.90	-23	36.7	25.0
-02	7.59	6.00	-24	12.5	8.77
-03	6.51	5.70	-25	37.0	29.0
-04	139	41.0	-26	17.3	13.0
-05	5.78	1.90	-27	13.9	10.6
-06	10.6	6.60	-28	14.8	11.7

Table A-IV-1 (Continued). Duplicate Sample Comparisons for LAS Laboratories and On-site Analyses

Sample Number	Activity (pCi/g)		Sample Number	Activity (pCi/g)	
	LAS	On-site		LAS	On-site
12-WS-31...	8.79	8.50	12-BD-07	0.52	<0.17
-32	16.5	12.6	-08	0.27	<0.14
-33	18.3	14.3	-11	0.32	0.72
-34	14.7	11.6	-12	0.75	<0.72
-36	13.8	11.2	-13	0.32	<0.16
-37	15.5	12.9	-14	0.75	... <0.66
-38	17.2	12.3	-14-SP	1.71	1.40
-39	14.9	11.7	-15	8.22	6.53
-40	13.7	35.8	-25	12.4	11.8
12-BF-06	0.92	<0.17			

Sample Number	Activity (pCi/g)		Sample Number	Activity (pCi/g)	
	Barringer	On-site		Barringer	On-site
12-PVSS-01	0.50	<0.48	12-PVSS-U07	0.4	<0.16
-X01	1.3	0.61	-U08	1.0	0.59
-X02	4.6	4.07	-U09	1.2	0.89
-X03	7.0	6.68	-U10	1.7	0.86
-X04	6.4	6.32	-U11	0.9	0.79
-X05	1.8	1.16	-U12	0.3	<0.15
-X06	4.0	1.92	-S06	0.2	<0.19
-X07	6.2	4.08	-S07	5.8	4.44
-X08	4.8	3.68	-M03	0.2	<0.16
-X09	6.7	5.52	NRC-02	0.7	<0.18
-X10	4.4	3.83	12-WS-50...	6.8	8.7
-X11	3.0	2.21	-51	9.5	8.63
-X12	4.2	3.01	-52	7.3	6.64
-X13	1.3	1.15	-53	8.3	6.4
-X14	0.3	<0.16	-54	6.8	5.42
-X15	2.4	1.59	-55	8.7	17
-X16	3.6	1.43	-56	7.7	6.00
-U02	0.13	<0.11	12-BF-27...	3.5	4.35
-U03	1.1	0.99	-28	0.3	<0.17
-U04	1.2	0.74	-29	9.8	10.21
U06	1.1	1.51			

Appendix V

SUPPORTING ANALYTICAL DATA FOR QUOTED SAMPLE RESULTS

The following pages provide copies of the supporting data for the analytical results quoted in this report as they refer to the termination survey for the WRMDF. Not included are samples taken to support the Field Screening Protocol, the Split Sample Comparisons, and the Establishment of the Revised Field Limit. Tables AV-1.2 and 3 provide a list of the samples. The data is provided in three groups, data generated by LAS Laboratories, data generated on-site, and data generated by Barringer Laboratories. (NOTE: Laboratory data will be included in final draft of this closure report).

Table AV-1. Index of Termination Survey Samples Analyzed by LAS Laboratories					
Sample #	Sample #	Sample #	Sample #	Sample #	Sample #
12-SS-01-06	12-BF-07-84/01	12-SS-05-06	12-BF-13-18/01	12-SS-08-06	E-47
12-SS-02-66	12-BF-08-96/01	12-SS-06-06	12-BF-14-116/01	12-BF-16-57/01	E-48
12-SS-03-06	12-SS-04-06	12-SS-07-06	12-SS-09-06	12-BF-14-SP	E-49
12-BF-15-70/01	12-BF-25-39/01				

Table AV-2. Index of Termination Survey Samples Analyzed on Site					
Sample #	Sample #	Sample #	Sample #	Sample #	Sample #
C-01	C-05	E-44	E-49	E-52	E-54
C-02	C-06	E-47	E-45	E-53	C-04
C-03	E-43	E-48	E-46	E-55	E-63

Table AV-3. Index of Termination Survey Samples Analyzed by Barringer Laboratories

| Sample #        |
|-------------|-------------|-------------|-------------|-------------|-----------------|
| 12-PVSS-X01 | 12-PVSS-X11 | 12-PVSS-U03 | 12-PVSS-U13 | 12-PVSS-S03 | 12-PVSS-S13     |
| 12-PVSS-X02 | 12-PVSS-X12 | 12-PVSS-U04 | 12-PVSS-M01 | 12-PVSS-S04 | 12-BF-12-12/01  |
| 12-PVSS-X03 | 12-PVSS-X13 | 12-PVSS-U05 | 12-PVSS-M02 | 12-PVSS-S05 | 12-BF-13-15/01  |
| 12-PVSS-X04 | 12-PVSS-X14 | 12-PVSS-U06 | 12-PVSS-M03 | 12-PVSS-S06 | 12-BF-27-25/01  |
| 12-PVSS-X05 | 12-PVSS-X15 | 12-PVSS-U07 | 12-PVSS-M04 | 12-PVSS-S07 | 12-BF-28-21/01  |
| 12-PVSS-X06 | 12-PVSS-X16 | 12-PVSS-U08 | 12-PVSS-M05 | 12-PVSS-S08 | 12-BF-29-104/01 |
| 12-PVSS-X07 | 12-PVSS-X17 | 12-PVSS-U09 | 12-PVSS-M06 | 12-PVSS-S09 |                 |
| 12-PVSS-X08 | 12-PVSS-X18 | 12-PVSS-U10 | 12-PVSS-M07 | 12-PVSS-S10 |                 |
| 12-PVSS-X09 | 12-PVSS-U01 | 12-PVSS-U11 | 12-PVSS-S01 | 12-PVSS-S11 |                 |
| 12-PVSS-X10 | 12-PVSS-U02 | 12-PVSS-U12 | 12-PVSS-S02 | 12-PVSS-S12 |                 |

**SAMPLES ANALYZED BY LAS LABORATORIES**



# ***LAS Laboratories, Inc.***

**KEMRON ENVIRONMENTAL SERVICES**

**ANALYTICAL DATA REPORT**

**FOR**

**GAMMA SPECTROMETRY**

LOG-IN NUMBER	<u>L10440</u>
QUOTATION NUMBER	<u>Q706259A</u>
DOCUMENT FILE NUMBER	<u>0905784</u>



October 7, 1997

Ms. Maren Beery  
Kemron Environmental Services  
109 Starlite Park  
Marietta, OH 45750

RE:    **Log-in No.                   L10440**  
      **Quotation No.            Q706259A**  
      **Document File No.       0905784**

The attached data report contains the analytical results of samples that were submitted to LAS Laboratories, Inc. on 5 September 1997. The temperature of the cooler upon receipt was 20°C. All sample containers coincided with the chain-of-custody documentation. All sample containers were received intact. Samples were received in time to meet the analytical holding time requirements. All discrepancies (if applicable) identified upon receipt of the samples have been forwarded to the client and are documented in the enclosed chain-of-custody records. (See attached Sample Receiving Checklist for details).

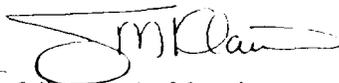
The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Jimmy Morales at (702) 361-3955, ext. 274. If you are unable to contact the client services representative, please call Daniel Fischer, client services manager, at extension 240.

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

Sincerely,

  
For Jimmy A. Morales  
Client Services Representative

cc:    Client Services  
      Document Control

**CASE NARRATIVE  
RADIOCHEMICAL ANALYSES**

The routine calibration and quality control (QC) analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, matrix spike samples, and duplicate samples.

**Holding Time Requirements**

All holding time requirements were met.

**Gamma Spectrometry**

*Analytical Method Gamma Spectrometry*

The gamma spectrometry analysis was performed using standard operating procedure (SOP) LAL-91-SOP-0064. The samples were analyzed in workgroup 53174. The instrument calibration verification met criteria. The method blank results for Pb-214/B1-214 were above the minimum detectable activity (MDA) and at or below the reporting detection limits (RDL). This is not expected to significantly impact sample results, therefore the data were reported. The laboratory control sample (LCS) recoveries were within QC criteria. The (duplicate) DUP recoveries were within QC criteria. No re-analyses were performed.

Lydia M. Coleman  
Prepared By

October 6, 1997  
Date

**LAS Laboratories, Inc.**  
**DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES**  
*[Revised 04/05/96]*

<b>For Use on the Analytical Data Reporting Forms</b>	
<b>B</b>	Any constituent that was detected in the associated method blank at a concentration was greater than the reporting detection limit (RDL).
<b>C</b>	The minimum detectable activity exceeded the RDL due to the residue weight limitations forcing a volume reduction.
<b>D</b>	Constituent detected in the diluted sample.
<b>E</b>	Constituent concentration exceeded the calibration or attenuation curve range.
<b>F</b>	<i>For Alpha Spectrometry Only</i> -- Full width half max exceeded the acceptance limits.
<b>H</b>	Sample analysis performed outside of method-specified maximum holding time requirement.
<b>Y</b>	Chemical yield exceeded acceptance limits.
<b>For Use on the QC Data Reporting Forms</b>	
<b>*</b>	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
<b>a<sup>1</sup></b>	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
<b>b<sup>1</sup></b>	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

<sup>1</sup> Used as foot note designations on the QC summary form.



LAS LABORATORIES  
 LOGIN CHAIN OF CUSTODY REPORT (ln01)  
 Sep 05 1997, 12:04 pm

Login Number: L10440  
 Account: 784 Kemron Environmental Svcs., Marietta, OH  
 Project: LANL RAD ANALYSES Radiological Analyses

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L10440-1 Gamma=LAS Library, Temp 20 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:18-FEB-98	12-SS-01-06	22-AUG-97	05-SEP-97	26-SEP-97
L10440-2 Gamma=LAS Library, Temp 20 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:18-FEB-98	12-SS-02-06	22-AUG-97	05-SEP-97	26-SEP-97
L10440-3 Gamma=LAS Library, Temp 20 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:18-FEB-98	12-SS-03-06	22-AUG-97	05-SEP-97	26-SEP-97
L10440-4 Gamma=LAS Library, Temp 20 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:24-FEB-98	12-WS-01-I2697ML	28-AUG-97	05-SEP-97	26-SEP-97
L10440-5 Gamma=LAS Library, Temp 20 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:02-MAR-98	12-BF-07-84/01	03-SEP-97	05-SEP-97	26-SEP-97
L10440-6 Gamma=LAS Library, Temp 20 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:02-MAR-98	12-BF-08-96/01	03-SEP-97	05-SEP-97	26-SEP-97
L10440-7 Location: Water 1 S EDD - DISK DEL. Water 1 S MORALES Water 1 S RAD RPT TYPE 4	REPORT TYPE	05-SEP-97	05-SEP-97	26-SEP-97

Signature: *Gail Astyeman*  
 Date: 9/5/97

0905784



Sample Receiving Checklist

Client Name: REMCON

Job No: U10440

Cooler ID: \_\_\_\_\_

0905784

**COOLER CONDITION UPON RECEIPT**

Temperature of cooler upon receipt: 20°

temperature of temp. blank upon receipt: \_\_\_\_\_

	yes	no	n/a	*Comments/Discrepancies
custody seals present	✓			
custody seals intact	✓			
chain of custody present	✓			
blue ice(or equiv.)present		✓		
blue ice(or equiv.)frozen			✓	
rad survey completed	✓			

**SAMPLE CONDITION UPON RECEIPT**

	yes	no	n/a	*Comments/Discrepancies
all bottles labeled	✓			
bottle custody seal present	✓			
bottle custody seal intact	✓			
samples intact	✓			
proper container used for sample	✓			
sample volume sufficient for analysis	✓			
proper pres. indicated on the COC	✓			
VOA's contain headspace			✓	
are samples bi-phasic(if so, indicate sample ID's):		✓		

**MISCELLANEOUS ITEMS**

	yes	no	n/a	*Comments/Discrepancies
samples with short holding times		✓		
samples to subcontract		✓		

**ADDITIONAL COMMENTS/DISCREPANCIES**

Completed by / date: [Signature] / 9.5.97

sent to the client (date/initials): \_\_\_\_\_ \*\* Client's signature upon receipt:

Notes: \* = contact the appropriate CSR of any discrepancies immediately upon receipt

\*\* = please review this information and return via facsimile to the appropriate CSR (702)361-8146

LAS Laboratories  
 SAMPLE SUMMARY REPORT (su02 S1)  
 Kemron Environmental Svcs., Marietta, OH

Client Sample Number	LAL Sample Number	SDG Number	Matrix	Method
12-BF-07-84/01 ✓	L10440-5		Soil ✓	GAMMA SPEC LAL-0
12-BF-08-96/01 ✓	L10440-6		Soil ✓	GAMMA SPEC LAL-0
12-SS-01-06 ✓	L10440-1		Soil ✓	GAMMA SPEC LAL-0
12-SS-02-06 ✓	L10440-2		Soil ✓	GAMMA SPEC LAL-0
12-SS-03-06 ✓	L10440-3		Soil ✓	GAMMA SPEC LAL-0
12-WS-01-I2697ML ✓	L10440-4		Soil ✓	GAMMA SPEC LAL-0
REPORT TYPE	L10440-7		Water	EDD - DISK DEL. ✓
	L10440-7 ✓		Water	MORALES ✓
	L10440-7		Water	RAD RPT TYPE 4 ✓

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH  
Project Name: LANL RAD ANALYSES  
Project Desc: Radiological Analyses

Client Sample ID: 12-SS-01-06  
Date Collected: 22-AUG-97  
Matrix: Soil

Login Number: L10440  
Date Received: 05-SEP-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	53174	1.01	0.27	0.32		pCi/g	17-SEP-97	L10440-1
Bi-212	LAL-0064	53174	0.65	0.49	0.61		pCi/g	17-SEP-97	L10440-1
Bi-214	LAL-0064	53174	0.90	0.18	0.17		pCi/g	17-SEP-97	L10440-1
Co-57	LAL-0064	53174	-0.004	0.018	0.042		pCi/g	17-SEP-97	L10440-1
Co-60	LAL-0064	53174	0.016	0.036	0.081		pCi/g	17-SEP-97	L10440-1
Cs-134	LAL-0064	53174	0.014	0.037	0.068		pCi/g	17-SEP-97	L10440-1
Cs-137	LAL-0064	53174	5.89	0.64	0.084		pCi/g	17-SEP-97	L10440-1
K-40	LAL-0064	53174	7.1	1.5	0.95		pCi/g	17-SEP-97	L10440-1
Pb-210	LAL-0064	53174	6.4	1.4	1.5		pCi/g	17-SEP-97	L10440-1
Pb-212	LAL-0064	53174	1.05	0.17	0.13		pCi/g	17-SEP-97	L10440-1
Pb-214	LAL-0064	53174	0.85	0.16	0.18		pCi/g	17-SEP-97	L10440-1
Ra-226(GAMMA)	LAL-0064	53174	2.0	1.2	1.6		pCi/g	17-SEP-97	L10440-1
Th-234	LAL-0064	53174	1.58	0.62	1.0		pCi/g	17-SEP-97	L10440-1
Tl-208	LAL-0064	53174	0.267	0.088	0.097		pCi/g	17-SEP-97	L10440-1
U-235(GAMMA)	LAL-0064	53174	0.03	0.25	0.39		pCi/g	17-SEP-97	L10440-1

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH  
Project Name: LANL RAD ANALYSES  
Project Desc: Radiological Analyses

Client Sample ID: 12-SS-02-06  
Date Collected: 22-AUG-97  
Matrix: Soil

Login Number: L10440  
Date Received: 05-SEP-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	53174	1.07	0.13	0.11		pCi/g	17-SEP-97	L10440-2
Bi-212	LAL-0064	53174	0.55	0.18	0.18		pCi/g	17-SEP-97	L10440-2
Bi-214	LAL-0064	53174	0.573	0.081	0.070		pCi/g	17-SEP-97	L10440-2
Co-57	LAL-0064	53174	-0.001	0.012	0.021		pCi/g	17-SEP-97	L10440-2
Co-60	LAL-0064	53174	0	0.011	0.025		pCi/g	17-SEP-97	L10440-2
Cs-134	LAL-0064	53174	-0.010	0.012	0.026		pCi/g	17-SEP-97	L10440-2
Cs-137	LAL-0064	53174	0.105	0.028	0.029		pCi/g	17-SEP-97	L10440-2
K-40	LAL-0064	53174	8.1	1.0	0.35		pCi/g	17-SEP-97	L10440-2
Pb-210	LAL-0064	53174	1.7	2.4	3.4		pCi/g	17-SEP-97	L10440-2
Pb-212	LAL-0064	53174	0.99	0.12	0.051		pCi/g	17-SEP-97	L10440-2
Pb-214	LAL-0064	53174	0.781	0.084	0.055		pCi/g	17-SEP-97	L10440-2
Ra-226(GAMMA)	LAL-0064	53174	1.46	0.48	0.59		pCi/g	17-SEP-97	L10440-2
Th-234	LAL-0064	53174	1.35	0.37	0.50		pCi/g	17-SEP-97	L10440-2
Tl-208	LAL-0064	53174	0.323	0.048	0.028		pCi/g	17-SEP-97	L10440-2
U-235(GAMMA)	LAL-0064	53174	0.03	0.11	0.18		pCi/g	17-SEP-97	L10440-2

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH

Project Name: LANL RAD ANALYSES

Project Desc: Radiological Analyses

Client Sample ID: 12-SS-03-06

Date Collected: 22-AUG-97

Matrix: Soil

Login Number: L10440

Date Received: 05-SEP-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	53174	0.70	0.14	0.14		pCi/g	16-SEP-97	L10440-3
Bi-212	LAL-0064	53174	0.35	0.20	0.27		pCi/g	16-SEP-97	L10440-3
Bi-214	LAL-0064	53174	0.457	0.094	0.084		pCi/g	16-SEP-97	L10440-3
Co-57	LAL-0064	53174	-0.0025	0.0096	0.021		pCi/g	16-SEP-97	L10440-3
Co-60	LAL-0064	53174	-0.014	0.013	0.043		pCi/g	16-SEP-97	L10440-3
Cs-134	LAL-0064	53174	0.001	0.020	0.036		pCi/g	16-SEP-97	L10440-3
Cs-137	LAL-0064	53174	0.254	0.050	0.046		pCi/g	16-SEP-97	L10440-3
K-40	LAL-0064	53174	5.19	0.88	0.39		pCi/g	16-SEP-97	L10440-3
Pb-210	LAL-0064	53174	1.70	0.67	0.87		pCi/g	16-SEP-97	L10440-3
Pb-212	LAL-0064	53174	0.649	0.093	0.059		pCi/g	16-SEP-97	L10440-3
Pb-214	LAL-0064	53174	0.549	0.082	0.078		pCi/g	16-SEP-97	L10440-3
Ra-226(GAMMA)	LAL-0064	53174	1.04	0.52	0.69		pCi/g	16-SEP-97	L10440-3
Th-234	LAL-0064	53174	0.49	0.31	0.54		pCi/g	16-SEP-97	L10440-3
Tl-208	LAL-0064	53174	0.202	0.047	0.040		pCi/g	16-SEP-97	L10440-3
U-235(GAMMA)	LAL-0064	53174	-0.01	0.12	0.19		pCi/g	16-SEP-97	L10440-3

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH  
Project Name: LANL RAD ANALYSES  
Project Desc: Radiological Analyses

Client Sample ID: 12-BF-07-84/01  
Date Collected: 03-SEP-97  
Matrix: Soil

Login Number: L10440  
Date Received: 05-SEP-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	53174	1.13	0.14	0.10		pCi/g	16-SEP-97	L10440-5
Bi-212	LAL-0064	53174	0.54	0.20	0.22		pCi/g	16-SEP-97	L10440-5
Bi-214	LAL-0064	53174	1.10	0.12	0.076		pCi/g	16-SEP-97	L10440-5
Co-57	LAL-0064	53174	0.002	0.013	0.022		pCi/g	16-SEP-97	L10440-5
Co-60	LAL-0064	53174	-0.0071	0.010	0.026		pCi/g	16-SEP-97	L10440-5
Cs-134	LAL-0064	53174	-0.003	0.013	0.027		pCi/g	16-SEP-97	L10440-5
Cs-137	LAL-0064	53174	0.521	0.068	0.031		pCi/g	16-SEP-97	L10440-5
K-40	LAL-0064	53174	8.6	1.1	0.34		pCi/g	16-SEP-97	L10440-5
Pb-210	LAL-0064	53174	0.5	2.5	3.7		pCi/g	16-SEP-97	L10440-5
Pb-212	LAL-0064	53174	1.10	0.13	0.055		pCi/g	16-SEP-97	L10440-5
Pb-214	LAL-0064	53174	1.33	0.12	0.064		pCi/g	16-SEP-97	L10440-5
Ra-226(GAMMA)	LAL-0064	53174	3.27	0.62	0.60		pCi/g	16-SEP-97	L10440-5
Th-234	LAL-0064	53174	1.41	0.40	0.55		pCi/g	16-SEP-97	L10440-5
U-238	LAL-0064	53174	0.336	0.050	0.032		pCi/g	16-SEP-97	L10440-5
U-235(GAMMA)	LAL-0064	53174	0	0.11	0.19		pCi/g	16-SEP-97	L10440-5

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH

Project Name: LANL RAD ANALYSES

Project Desc: Radiological Analyses

Client Sample ID: 12-BF-08-96/01

Date Collected: 03-SEP-97

Matrix: Soil

Login Number: L10440

Date Received: 05-SEP-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	53174	0.96	0.17	0.16		pCi/g	16-SEP-97	L10440-6
Bi-212	LAL-0064	53174	0.63	0.28	0.31		pCi/g	16-SEP-97	L10440-6
Bi-214	LAL-0064	53174	0.68	0.11	0.086		pCi/g	16-SEP-97	L10440-6
Co-57	LAL-0064	53174	0.004	0.015	0.025		pCi/g	16-SEP-97	L10440-6
Co-60	LAL-0064	53174	0.009	0.018	0.036		pCi/g	16-SEP-97	L10440-6
Cs-134	LAL-0064	53174	0	0.013	0.038		pCi/g	16-SEP-97	L10440-6
Cs-137	LAL-0064	53174	0.273	0.051	0.045		pCi/g	16-SEP-97	L10440-6
K-40	LAL-0064	53174	6.9	1.0	0.47		pCi/g	16-SEP-97	L10440-6
Pb-210	LAL-0064	53174	1.67	0.79	1.1		pCi/g	16-SEP-97	L10440-6
Pb-212	LAL-0064	53174	0.94	0.13	0.079		pCi/g	16-SEP-97	L10440-6
Pb-214	LAL-0064	53174	0.773	0.10	0.090		pCi/g	16-SEP-97	L10440-6
Ra-226(GAMMA)	LAL-0064	53174	1.70	0.73	0.99		pCi/g	16-SEP-97	L10440-6
Th-234	LAL-0064	53174	0.94	0.42	0.73		pCi/g	16-SEP-97	L10440-6
Tl-208	LAL-0064	53174	0.288	0.056	0.046		pCi/g	16-SEP-97	L10440-6
U-235(GAMMA)	LAL-0064	53174	0.08	0.15	0.24		pCi/g	16-SEP-97	L10440-6



# ***LAS Laboratories, Inc.***

**KEMRON ENVIRONMENTAL SERVICES**

**ANALYTICAL DATA REPORT**

**FOR**

**GAMMA SPECTROMETRY AND GROSS  
ALPHA/BETA**

LOG-IN NUMBER	<u>L10546</u>
QUOTATION NUMBER	<u>Q706259A</u>
DOCUMENT FILE NUMBER	<u>0918784</u>



October 7, 1997

Ms. Maren Beery  
Kemron Environmental Services  
109 Starlite Park  
Marietta, OH 45750

RE:    **Log-in No.                   L10546**  
      **Quotation No.               Q706259A**  
      **Document File No.         0918784**

The attached data report contains the analytical results of samples that were submitted to LAS Laboratories, Inc. on 18 September 1997. The temperature of the cooler upon receipt was 25°C. All sample containers coincided with the chain-of-custody documentation. All sample containers were received intact. Samples were received in time to meet the analytical holding time requirements. All discrepancies (if applicable) identified upon receipt of the samples have been forwarded to the client and are documented in the enclosed chain-of-custody records. (See attached Sample Receiving Checklist for details).

The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Jimmy Morales at (702) 361-3955, ext. 274. If you are unable to contact the client services representative, please call Daniel Fischer, client services manager, at extension 240.

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

Sincerely,

  
For Jimmy A. Morales  
Client Services Representative

cc:    Client Services  
      Document Control

## CASE NARRATIVE RADIOCHEMICAL ANALYSES

The routine calibration and quality control (QC) analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, matrix spike samples, and duplicate samples.

### Holding Time Requirements

All holding time requirements were met.

### Gamma Spectrometry

#### *Analytical Method Gamma Spectrometry*

The gamma spectrometry analysis was performed using standard operating procedures (SOP) LAL-91-SOP-0063 and LAL-91-SOP-0064. The samples were analyzed in workgroups 53834 and 53835. The instrument calibration verification met criteria. The method blank results were within QC criteria. The laboratory control sample (LCS) recoveries were within QC criteria. The (duplicate) DUP recoveries were within QC criteria. No re-analyses were performed.

### Gas Proportional Counter

#### *Analytical Method Gross Alpha/Beta*

The gross alpha/beta analysis was performed using SOP, LAL-91-SOP-0060. The samples were analyzed in workgroup 53713. The instrument calibration verification met criteria. The method blank results were within QC criteria. The LCS recoveries were within QC criteria. The DUP recoveries were within QC criteria. No re-analyses were performed.

Lydia M. Coleman  
Prepared By

October 6, 1997  
Date

**LAS Laboratories, Inc.**  
**DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES**  
*[Revised 04/05/96]*

<b>For Use on the Analytical Data Reporting Forms</b>	
<b>B</b>	Any constituent that was detected in the associated method blank at a concentration was greater than the reporting detection limit (RDL).
<b>C</b>	The minimum detectable activity exceeded the RDL due to the residue weight limitations forcing a volume reduction.
<b>D</b>	Constituent detected in the diluted sample.
<b>E</b>	Constituent concentration exceeded the calibration or attenuation curve range.
<b>F</b>	<i>For Alpha Spectrometry Only</i> -- Full width half max exceeded the acceptance limits.
<b>H</b>	Sample analysis performed outside of method-specified maximum holding time requirement.
<b>Y</b>	Chemical yield exceeded acceptance limits.
<b>For Use on the QC Data Reporting Forms</b>	
<b>*</b>	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
<b>a<sup>1</sup></b>	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
<b>b<sup>1</sup></b>	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

<sup>1</sup> Used as foot note designations on the QC summary form.

LAS LABORATORIES  
 LOGIN CHAIN OF CUSTODY REPORT (ln01)  
 Sep 19 1997, 12:51 pm

Login Number: L10546  
 Account: 784 Kemron Environmental Svcs., Marietta, OH  
 Project: LANL RAD ANALYSES Radiological Analyses

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L10546-1 Gamma=LAS Library, Temp 25 Location: 156-003 Soil 4 S GAMMA SPEC LAL-0064	12-SS-04-06	15-SEP-97	18-SEP-97	25-SEP-97
Hold:14-MAR-98				
L10546-2 Gamma=LAS Library, Temp 25 Location: 156-003 Soil 4 S GAMMA SPEC LAL-0064	12-SS-05-06	15-SEP-97	18-SEP-97	25-SEP-97
Hold:14-MAR-98				
L10546-3 Gamma=LAS Library, Temp 25 Location: 156-003 Soil 4 S GAMMA SPEC LAL-0064	12-SS-06-06	15-SEP-97	18-SEP-97	25-SEP-97
Hold:14-MAR-98				
L10546-4 Gamma=LAS Library, Temp 25 Location: 156-003 Soil 4 S GAMMA SPEC LAL-0064	12-SS-07-06	15-SEP-97	18-SEP-97	25-SEP-97
Hold:14-MAR-98				
L10546-5 Gamma=LAS Library, Temp 25 Location: 156-003 Soil 4 S GAMMA SPEC LAL-0064	12-WS-02-IS26443ML	08-SEP-97	18-SEP-97	25-SEP-97
Hold:07-MAR-98				
L10546-6 Gamma=LAS Library, Temp 25 Location: 156-003 Soil 4 S GAMMA SPEC LAL-0064	12-WS-03-IS2538ML	09-SEP-97	18-SEP-97	25-SEP-97
Hold:08-MAR-98				
L10546-7 Gamma=LAS Library, Temp 25 Location: 156-003 Soil 4 S GAMMA SPEC LAL-0064	12-BF-13-18/01	16-SEP-97	18-SEP-97	25-SEP-97
Hold:15-MAR-98				
L10546-8 Gamma=LAS Library, Temp 25 Location: 156-003 Soil 4 S GAMMA SPEC LAL-0064	12-BF-14-116/01	16-SEP-97	18-SEP-97	25-SEP-97
Hold:15-MAR-98				
L10546-9 Gamma=LAS Library, Temp 25 Location: 156-003 Water 1 S GAMMA SPEC LAL-0063	12-RW-01-HW	17-SEP-97	18-SEP-97	25-SEP-97
Hold:16-MAR-98				

0918784

LAS LABORATORIES  
 LOGIN CHAIN OF CUSTODY REPORT (1n01)  
 Sep 19 1997, 12:51 pm

Login Number: L10546  
 Account: 784 Kemron Environmental Svcs., Marietta, OH  
 Project: LANL RAD ANALYSES Radiological Analyses

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L10546-10 Gamma=LAS Library, Temp 25 Location: 156-003 Water 1 S GAMMA SPEC LAL-0063 Hold:16-MAR-98	12-SW-02-ST	17-SEP-97	18-SEP-97	25-SEP-97
L10546-11 Temp 25 Location: 142 Water 1 S GR ALP/BETA LAL-0060 Hold:16-MAR-98	12-RW-01-HW	17-SEP-97	18-SEP-97	25-SEP-97
L10546-12 Temp 25 Location: 142 Water 1 S GR ALP/BETA LAL-0060 Hold:16-MAR-98	12-SW-02-ST	17-SEP-97	18-SEP-97	25-SEP-97
L10546-13 Location: Water 1 S EDD - DISK DEL. Water 1 S MORALES Water 1 S RAD RPT TYPE 4	REPORT TYPE	18-SEP-97	18-SEP-97	25-SEP-97

Signature: *gja.m.l*  
 Date: 9/19/97

0918784

CHAIN-OF-CUSTODY RECORD

L 10639

Project Contact:		PHONE 410-671-6015		MR. TIM REESE		FAX 410-671-6018		NUMBER OF SAMPLES	Hold	GAMMA SPEC	ADDITIONAL REQUIREMENTS				
Turn Around Requirements:		7 DAY TURNAROUND													
Project No.:	Project Name: WESTWOOD RADIOACTIVE MATERIALS DISPOSAL FACILITY														
Sampler (print):		Signature: <i>Frederick L. Aase</i>													
Sample I.D. No.	Comp.	Grab	Date	Time	Protocol CWA SW846										
12-WS-06-26464	✓		23 SEPT. 97	1240											
E-36		✓	23 SEPT. 97	1425											
E-37		✓	23 SEPT. 97	1450											
12-WS-07-IS 2639M1	✓		24 SEPT. 97	1345											
E-47		✓	29 SEPT. 97	1210											
E-48		✓	29 SEPT. 97	1215											
E-49		✓	29 SEPT. 97	1220											
<i>NO FURTHER ENTRIES PLEASE</i>															
Relinquished by: (Signature)		Date	Time	Received by: (Signature)		Relinquished by: (Signature)		Date	Time	Received by: (Signature)					
<i>Frederick L. Aase</i>		23 SEPT 97	1345												
Relinquished by: (Signature)		Date	Time	Received for Laboratory by: (Signature)		Date	Time	Remarks:							
				<i>Hail Ackerman</i>		10/1/97	0830								

\*Homogenize all composite samples prior to analysis



Sample Login  
Login Review Checklist

Login Number L 10639

The Login Review Checklist documents the review of the information entered into the ACS database for accuracy and useability. For effective login review, five items are necessary. They are the Chain of Custody (COC) (or equivalent), the Sample Summary Report (SSR), the Login COC Report, the Sample Receiving Checklist, and the Quote/COC Reconciliation Form. This checklist should be affixed to each login package prior to distribution.

SAMPLE SUMMARY REPORT

	<u>YES</u>	<u>NO</u>	<u>N/A</u>	<u>COMMENT</u>
1. Are all samples on the COC logged in or the proper discrepancies noted on the SSR?	<u>X</u>	—	—	_____
2. Are all Client Sample IDs logged in correctly?	<u>X</u>	—	—	_____
3. Are all matrices indicated correctly?	<u>X</u>	—	—	_____
4. Are all analyses on the COC logged in for appropriate samples?	<u>X</u>	—	—	_____
5. Are samples logged in for the proper products?	<u>X</u>	—	—	_____

LOGIN CHAIN OF CUSTODY REPORT

	<u>YES</u>	<u>NO</u>	<u>N/A</u>	<u>COMMENT</u>
1. Are the collect, receive, and due dates correct for every sample?	<u>X</u>	—	—	_____
2. Have all appropriate comments been included?	<u>X</u>	—	—	_____

SAMPLE RECEIVING CHECKLIST

	<u>YES</u>	<u>NO</u>	<u>N/A</u>	<u>COMMENT</u>
1. Are all discrepancies between the COC and login noted (if applicable)?	<u>X</u>	—	—	_____

LOGIN pH CHECK (applicable projects only)

	<u>YES</u>	<u>NO</u>	<u>N/A</u>	<u>COMMENT</u>
1. Has the pH of all aqueous samples been checked and the report attached?	—	—	<u>X</u>	_____

Jane P. [Signature] 10-01-97  
Login Specialist signature date

[Signature] 10/11/97  
Secondary Reviewer signature date

[Signature] 10/2/97  
Project Management signature date

LAS LABORATORIES, INC.  
Sample Receiving Checklist

Client Name: Foster Wheeler

Job No: L10639

Cooler ID: \_\_\_\_\_

R01784

**COOLER CONDITION UPON RECEIPT**

Temperature of cooler upon receipt: 20°C

temperature of temp. blank upon receipt: \_\_\_\_\_

	yes	no	n/a	*Comments/Discrepancies
--	-----	----	-----	-------------------------

custody seals present

custody seals intact

chain of custody present

blue ice(or equiv.)present

blue ice(or equiv.)frozen

rad survey completed

**SAMPLE CONDITION UPON RECEIPT**

	yes	no	n/a	*Comments/Discrepancies
--	-----	----	-----	-------------------------

all bottles labeled

bottle custody seal present

bottle custody seal intact

samples intact

proper container used for sample

sample volume sufficient for analysis

proper pres. indicated on the COC

VOA's contain headspace

are samples bi-phasic(if so, indicate sample ID's): \_\_\_\_\_

**MISCELLANEOUS ITEMS**

	yes	no	n/a	*Comments/Discrepancies
--	-----	----	-----	-------------------------

samples with short holding times

samples to subcontract

**ADDITIONAL COMMENTS/DISCREPANCIES**

Completed by / date [Signature] 10/01/97

sent to the client (date/initials): \_\_\_\_\_

\*\* Client's signature upon receipt: \_\_\_\_\_

Notes: \* = contact the appropriate CSR of any discrepancies immediately upon receipt

\*\* = please review this information and return via facsimile to the appropriate CSR (702)361-8146





Sample Receiving Checklist

Client Name: KEMPOD ENVIRONMENTAL INC.

Job No: L10546

Cooler ID: \_\_\_\_\_

COOLER CONDITION UPON RECEIPT

Temperature of cooler upon receipt: 25c

temperature of temp. blank upon receipt:

	yes	no	n/a	*Comments/Discrepancies
custody seals present	<input checked="" type="checkbox"/>			
custody seals intact	<input checked="" type="checkbox"/>			
chain of custody present	<input checked="" type="checkbox"/>			
blue ice(or equiv.)present		<input checked="" type="checkbox"/>		
blue ice(or equiv.)frozen			<input checked="" type="checkbox"/>	
rad survey completed	<input checked="" type="checkbox"/>			

SAMPLE CONDITION UPON RECEIPT

	yes	no	n/a	*Comments/Discrepancies
all bottles labeled	<input checked="" type="checkbox"/>			
bottle custody seal present	<input checked="" type="checkbox"/>			
bottle custody seal intact	<input checked="" type="checkbox"/>			
samples intact	<input checked="" type="checkbox"/>			
proper container used for sample	<input checked="" type="checkbox"/>			
sample volume sufficient for analysis	<input checked="" type="checkbox"/>			
proper pres. indicated on the COC	<input checked="" type="checkbox"/>			
VOA's contain headspace			<input checked="" type="checkbox"/>	
are samples bi-phasic(if so, indicate sample ID's):			<input checked="" type="checkbox"/>	

MISCELLANEOUS ITEMS

	yes	no	n/a	*Comments/Discrepancies
samples with short holding times		<input checked="" type="checkbox"/>		
samples to subcontract		<input checked="" type="checkbox"/>		

ADDITIONAL COMMENTS/DISCREPANCIES

Completed by / date: Jays Edal Chitt 9/18/97  
sent to the client (date/initials): \_\_\_\_\_ \*\* Client's signature upon receipt:

Notes: \* = contact the appropriate CSR of any discrepancies immediately upon receipt

\*\* = please review this information and return via facsimile to the appropriate CSR (702)361-8146

0918784  
4868160

# LAS LABORATORIES

## LOGIN pH CHECK

CLIENT: Kemron Environmental Svcs., Marietta, OH(784)  
PROJECT: LANL RAD ANALYSES  
LOGIN: L10546  
MATRIX: Water(1)

NO	LAL #	CLIENT ID	PRODUCT	pH
1	L10546-9	12-RW-01-HW	GAMMA SPEC LAL-0063	6.4 9.1 pH 6
2	L10546-10	12-SW-02-ST	GAMMA SPEC LAL-0063	6
3	L10546-11	12-RW-01-HW	GR ALP/BETA LAL-0060	6
4	L10546-12	12-SW-02-ST	GR ALP/BETA LAL-0060	6
5	L10546-13	REPORT TYPE	EDD - DISK DEL.	
6	L10546-13	REPORT TYPE	MORALES	
7	L10546-13	REPORT TYPE	RAD RPT TYPE 4	

Signature: Neil Achman Date: 9/18/97

LAS Laboratories  
 SAMPLE SUMMARY REPORT (su02 S1)  
 Kemron Environmental Svcs., Marietta, OH

Client Sample Number	LAL Sample Number	SDG Number	Matrix	Method
12-BF-13-18/01	L10546-7		Soil	GAMMA SPEC LAL-C
12-BF-14-116/01	L10546-8		Soil	GAMMA SPEC LAL-O
12-RW-01-HW	L10546-9 L10546-11		Water Water	GAMMA SPEC LAL-C GR ALP/BETA LAL-
12-SS-04-06	L10546-1		Soil	GAMMA SPEC LAL-C
12-SS-05-06	L10546-2		Soil	GAMMA SPEC LAL-O
12-SS-06-06	L10546-3		Soil	GAMMA SPEC LAL-C
12-SS-07-06	L10546-4		Soil	GAMMA SPEC LAL-O
12-SW-02-ST	L10546-10 L10546-12		Water Water	GAMMA SPEC LAL-C GR ALP/BETA LAL-
12-WS-02-IS26443ML	L10546-5		Soil	GAMMA SPEC LAL-C
12-WS-03-IS2538ML	L10546-6		Soil	GAMMA SPEC LAL-O
REPORT TYPE	L10546-13 L10546-13 L10546-13		Water Water Water	EDD - DISK DEL. MORALES RAD RPT TYPE 4

0918784

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH

Project Name: LANL RAD ANALYSES

Project Desc: Radiological Analyses

Client Sample ID: 12-SS-04-06

Date Collected: 15-SEP-97

Matrix: Soil

Login Number: L10546

Date Received: 18-SEP-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	53835	1.07	0.14	0.11		pCi/g	24-SEP-97	L10546-1
Bi-212	LAL-0064	53835	0.69	0.21	0.22		pCi/g	24-SEP-97	L10546-1
Bi-214	LAL-0064	53835	0.818	0.10	0.080		pCi/g	24-SEP-97	L10546-1
Co-57	LAL-0064	53835	-0.007	0.015	0.032		pCi/g	24-SEP-97	L10546-1
Co-60	LAL-0064	53835	0.003	0.012	0.026		pCi/g	24-SEP-97	L10546-1
Cs-134	LAL-0064	53835	-0.004	0.011	0.030		pCi/g	24-SEP-97	L10546-1
Cs-137	LAL-0064	53835	1.08	0.12	0.033		pCi/g	24-SEP-97	L10546-1
K-40	LAL-0064	53835	8.1	1.0	0.35		pCi/g	24-SEP-97	L10546-1
Pb-210	LAL-0064	53835	6.	26.	37.		pCi/g	24-SEP-97	L10546-1
Pb-212	LAL-0064	53835	1.01	0.12	0.064		pCi/g	24-SEP-97	L10546-1
Pb-214	LAL-0064	53835	0.998	0.10	0.069		pCi/g	24-SEP-97	L10546-1
Ra-226(GAMMA)	LAL-0064	53835	0.88	0.57	0.74		pCi/g	24-SEP-97	L10546-1
Th-234	LAL-0064	53835	2.24	0.71	0.93		pCi/g	24-SEP-97	L10546-1
Tl-208	LAL-0064	53835	0.310	0.050	0.035		pCi/g	24-SEP-97	L10546-1
U-235(GAMMA)	LAL-0064	53835	0.03	0.15	0.24		pCi/g	24-SEP-97	L10546-1

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH

Project Name: LANL RAD ANALYSES

Project Desc: Radiological Analyses

Client Sample ID: 12-SS-05-06

Date Collected: 15-SEP-97

Matrix: Soil

Login Number: L10546

Date Received: 18-SEP-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	53835	1.10	0.26	0.28		pCi/g	24-SEP-97	L10546-2
Bi-212	LAL-0064	53835	0.71	0.46	0.55		pCi/g	24-SEP-97	L10546-2
Bi-214	LAL-0064	53835	0.93	0.18	0.16		pCi/g	24-SEP-97	L10546-2
Co-57	LAL-0064	53835	0	0.027	0.039		pCi/g	24-SEP-97	L10546-2
Co-60	LAL-0064	53835	-0.002	0.028	0.094		pCi/g	24-SEP-97	L10546-2
Cs-134	LAL-0064	53835	-0.01	0.027	0.064		pCi/g	24-SEP-97	L10546-2
Cs-137	LAL-0064	53835	0.255	0.082	0.083		pCi/g	24-SEP-97	L10546-2
K-40	LAL-0064	53835	10.0	1.7	0.75		pCi/g	24-SEP-97	L10546-2
Pb-210	LAL-0064	53835	3.4	1.4	1.9		pCi/g	24-SEP-97	L10546-2
Pb-212	LAL-0064	53835	1.21	0.17	0.11		pCi/g	24-SEP-97	L10546-2
Pb-214	LAL-0064	53835	0.97	0.15	0.14		pCi/g	24-SEP-97	L10546-2
Ra-226(GAMMA)	LAL-0064	53835	1.1	1.0	1.4		pCi/g	24-SEP-97	L10546-2
Th-234	LAL-0064	53835	1.16	0.62	1.1		pCi/g	24-SEP-97	L10546-2
Tl-208	LAL-0064	53835	0.372	0.089	0.077		pCi/g	24-SEP-97	L10546-2
U-235(GAMMA)	LAL-0064	53835	0.08	0.22	0.33		pCi/g	24-SEP-97	L10546-2

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH  
Project Name: LANL RAD ANALYSES  
Project Desc: Radiological Analyses

Client Sample ID: 12-SS-06-06  
Date Collected: 15-SEP-97  
Matrix: Soil

Login Number: L10546  
Date Received: 18-SEP-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	53835	1.20	0.16	0.12		pCi/g	24-SEP-97	L10546-3
Bi-212	LAL-0064	53835	0.69	0.24	0.27		pCi/g	24-SEP-97	L10546-3
Bi-214	LAL-0064	53835	0.81	0.11	0.088		pCi/g	24-SEP-97	L10546-3
Co-57	LAL-0064	53835	0.003	0.023	0.033		pCi/g	24-SEP-97	L10546-3
Co-60	LAL-0064	53835	-0.004	0.013	0.031		pCi/g	24-SEP-97	L10546-3
Cs-134	LAL-0064	53835	0	0.013	0.034		pCi/g	24-SEP-97	L10546-3
Cs-137	LAL-0064	53835	0.280	0.046	0.036		pCi/g	24-SEP-97	L10546-3
K-40	LAL-0064	53835	10.1	1.3	0.42		pCi/g	24-SEP-97	L10546-3
Pb-210	LAL-0064	53835	8.	29.	42.		pCi/g	24-SEP-97	L10546-3
Pb-212	LAL-0064	53835	1.12	0.14	0.070		pCi/g	24-SEP-97	L10546-3
Pb-214	LAL-0064	53835	0.94	0.11	0.076		pCi/g	24-SEP-97	L10546-3
Ra-226(GAMMA)	LAL-0064	53835	0.00	0.66	0.81		pCi/g	24-SEP-97	L10546-3
Th-234	LAL-0064	53835	2.94	0.81	1.0		pCi/g	24-SEP-97	L10546-3
Tl-208	LAL-0064	53835	0.368	0.058	0.040		pCi/g	24-SEP-97	L10546-3
U-235(GAMMA)	LAL-0064	53835	0.03	0.16	0.26		pCi/g	24-SEP-97	L10546-3

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH

Project Name: LANL RAD ANALYSES

Project Desc: Radiological Analyses

Client Sample ID: 12-SS-07-06

Date Collected: 15-SEP-97

Matrix: Soil

Login Number: L10546

Date Received: 18-SEP-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	53835	0.56	0.14	0.17		pCi/g	24-SEP-97	L10546-4
Bi-212	LAL-0064	53835	0.43	0.26	0.30		pCi/g	24-SEP-97	L10546-4
Bi-214	LAL-0064	53835	0.377	0.083	0.079		pCi/g	24-SEP-97	L10546-4
Co-57	LAL-0064	53835	0	0.012	0.021		pCi/g	24-SEP-97	L10546-4
Co-60	LAL-0064	53835	-0.003	0.016	0.034		pCi/g	24-SEP-97	L10546-4
Cs-134	LAL-0064	53835	0.008	0.014	0.030		pCi/g	24-SEP-97	L10546-4
Cs-137	LAL-0064	53835	0.057	0.027	0.037		pCi/g	24-SEP-97	L10546-4
K-40	LAL-0064	53835	3.26	0.68	0.49		pCi/g	24-SEP-97	L10546-4
Pb-210	LAL-0064	53835	1.18	0.70	0.98		pCi/g	24-SEP-97	L10546-4
Pb-212	LAL-0064	53835	0.563	0.087	0.068		pCi/g	24-SEP-97	L10546-4
Pb-214	LAL-0064	53835	0.436	0.076	0.075		pCi/g	24-SEP-97	L10546-4
Ra-226(GAMMA)	LAL-0064	53835	0.29	0.64	0.91		pCi/g	24-SEP-97	L10546-4
Th-234	LAL-0064	53835	0.67	0.38	0.68		pCi/g	24-SEP-97	L10546-4
Tl-208	LAL-0064	53835	0.155	0.043	0.044		pCi/g	24-SEP-97	L10546-4
U-235(GAMMA)	LAL-0064	53835	0.06	0.13	0.20		pCi/g	24-SEP-97	L10546-4



# ***LAS Laboratories, Inc.***

**KEMRON ENVIRONMENTAL SERVICES**

**ANALYTICAL DATA REPORT**

**FOR**

**GAMMA SPECTROMETRY**

LOG-IN NUMBER	<u>L10639</u>
QUOTATION NUMBER	<u>Q706259A</u>
DOCUMENT FILE NUMBER	<u>1001784</u>



October 9, 1997

Ms. Maren Beery  
Kemron Environmental Services  
109 Starlite Park  
Marietta, OH 45750

RE:    **Log-in No.**                    **L10639**  
      **Quotation No.**            **Q706259A**  
      **Document File No.**       **1001784**

The attached data report contains the analytical results of samples that were submitted to LAS Laboratories, Inc. on October 1, 1997. The temperature of the cooler upon receipt was 20°C. All sample containers coincided with the chain-of-custody documentation. All sample containers were received intact. Samples were received in time to meet the analytical holding time requirements. All discrepancies (if applicable) identified upon receipt of the samples have been forwarded to the client and are documented in the enclosed chain-of-custody records. (See attached Sample Receiving Checklist for details).

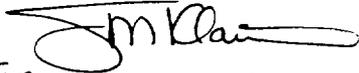
The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Jimmy Morales at (702) 361-3955, ext. 274. If you are unable to contact the client services representative, please call Daniel Fischer, client services manager, at extension 240.

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

Sincerely,

  
For Jimmy A. Morales  
Client Services Representative

cc:    Client Services  
      Document Control

**CASE NARRATIVE  
RADIOCHEMICAL ANALYSES**

The routine calibration and quality control (QC) analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, matrix spike samples, and duplicate samples.

**Holding Time Requirements**

All holding time requirements were met.

**Gamma Spectrometry**

*Analytical Method Gamma Spectrometry*

The gamma spectrometry analysis was performed using standard operating procedure, LAL-91-SOP-0064. The samples were analyzed in workgroup 54255. The instrument calibration verification met criteria. The method blank results were within QC criteria. The laboratory control sample recoveries were within QC criteria. The duplicate recoveries were within QC criteria. No re-analyses were performed.

Andrea Tippett  
Prepared By

October 1, 1997  
Date

**LAS Laboratories, Inc.**  
**DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES**  
*[Revised 04/05/96]*

<b>For Use on the Analytical Data Reporting Forms</b>	
<b>B</b>	Any constituent that was detected in the associated method blank at a concentration was greater than the reporting detection limit (RDL).
<b>C</b>	The minimum detectable activity exceeded the RDL due to the residue weight limitations forcing a volume reduction.
<b>D</b>	Constituent detected in the diluted sample.
<b>E</b>	Constituent concentration exceeded the calibration or attenuation curve range.
<b>F</b>	<i>For Alpha Spectrometry Only</i> -- Full width half max exceeded the acceptance limits.
<b>H</b>	Sample analysis performed outside of method-specified maximum holding time requirement.
<b>Y</b>	Chemical yield exceeded acceptance limits.
<b>For Use on the QC Data Reporting Forms</b>	
<b>*</b>	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
<b>a<sup>1</sup></b>	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
<b>b<sup>1</sup></b>	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

<sup>1</sup> Used as foot note designations on the QC summary form.

# - LAS LABORATORIES

## - RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH

Project Name: LANL RAD ANALYSES

Project Desc: Radiological Analyses

Client Sample ID: 12-BF-13-18/01

Date Collected: 16-SEP-97

Matrix: Soil

Login Number: L10546

Date Received: 18-SEP-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
- Ac-228	LAL-0064	53835	0.99	0.13	0.12		pCi/g	24-SEP-97	L10546-7
Bi-212	LAL-0064	53835	0.47	0.20	0.23		pCi/g	24-SEP-97	L10546-7
Bi-214	LAL-0064	53835	0.465	0.079	0.077		pCi/g	24-SEP-97	L10546-7
Co-57	LAL-0064	53835	0.005	0.016	0.022		pCi/g	24-SEP-97	L10546-7
Co-60	LAL-0064	53835	0.001	0.012	0.025		pCi/g	24-SEP-97	L10546-7
- Cs-134	LAL-0064	53835	0.0046	0.010	0.026		pCi/g	24-SEP-97	L10546-7
Cs-137	LAL-0064	53835	0.316	0.046	0.025		pCi/g	24-SEP-97	L10546-7
K-40	LAL-0064	53835	6.64	0.90	0.38		pCi/g	24-SEP-97	L10546-7
Pb-210	LAL-0064	53835	2.0	2.7	3.7		pCi/g	24-SEP-97	L10546-7
Pb-212	LAL-0064	53835	0.83	0.11	0.062		pCi/g	24-SEP-97	L10546-7
Pb-214	LAL-0064	53835	0.636	0.077	0.061		pCi/g	24-SEP-97	L10546-7
Ra-226(GAMMA)	LAL-0064	53835	0.55	0.49	0.68		pCi/g	24-SEP-97	L10546-7
Th-234	LAL-0064	53835	1.23	0.40	0.57		pCi/g	24-SEP-97	L10546-7
Tl-208	LAL-0064	53835	0.258	0.046	0.036		pCi/g	24-SEP-97	L10546-7
- U-235(GAMMA)	LAL-0064	53835	0.02	0.12	0.20		pCi/g	24-SEP-97	L10546-7

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH

Project Name: LANL RAD ANALYSES

Project Desc: Radiological Analyses

Client Sample ID: 12-BF-14-116/01

Date Collected: 16-SEP-97

Matrix: Soil

Login Number: L10546

Date Received: 18-SEP-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	53835	0.85	0.16	0.17		pCi/g	24-SEP-97	L10546-8
Bi-212	LAL-0064	53835	0.37	0.28	0.34		pCi/g	24-SEP-97	L10546-8
Bi-214	LAL-0064	53835	0.558	0.10	0.084		pCi/g	24-SEP-97	L10546-8
Co-57	LAL-0064	53835	0.01	0.014	0.024		pCi/g	24-SEP-97	L10546-8
Co-60	LAL-0064	53835	-0.013	0.019	0.050		pCi/g	24-SEP-97	L10546-8
Cs-134	LAL-0064	53835	0.014	0.017	0.035		pCi/g	24-SEP-97	L10546-8
Cs-137	LAL-0064	53835	0.751	0.099	0.047		pCi/g	24-SEP-97	L10546-8
K-40	LAL-0064	53835	6.05	0.97	0.47		pCi/g	24-SEP-97	L10546-8
Pb-210	LAL-0064	53835	1.34	0.78	1.1		pCi/g	24-SEP-97	L10546-8
Pb-212	LAL-0064	53835	0.86	0.12	0.079		pCi/g	24-SEP-97	L10546-8
Pb-214	LAL-0064	53835	0.616	0.095	0.092		pCi/g	24-SEP-97	L10546-8
Ra-226(GAMMA)	LAL-0064	53835	0.30	0.71	1.0		pCi/g	24-SEP-97	L10546-8
Th-234	LAL-0064	53835	1.42	0.44	0.74		pCi/g	24-SEP-97	L10546-8
Tl-208	LAL-0064	53835	0.274	0.057	0.049		pCi/g	24-SEP-97	L10546-8
U-235(GAMMA)	LAL-0064	53835	0.06	0.15	0.24		pCi/g	24-SEP-97	L10546-8

LAS LABORATORIES  
 LOGIN CHAIN OF CUSTODY REPORT (1n01)  
 Oct 02 1997, 10:23 am

Login Number: L10639  
 Account: 784 Kemron Environmental Svcs., Marietta, OH  
 Project: LANL RAD ANALYSES Radiological Analyses

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L10639-1 GS=LAS Library; Temp 20 Location: 156-004 Soil 4 S GAMMA SPEC LAL-0064 Soil 4 S RAD PERCENT SOLIDS	12-WS-06-26464	23-SEP-97	01-OCT-97	08-OCT-97
L10639-2 GS=LAS Library; Temp 20 Location: 156-004 Soil 4 S GAMMA SPEC LAL-0064 Soil 4 S RAD PERCENT SOLIDS	E-36	23-SEP-97	01-OCT-97	08-OCT-97
L10639-3 GS=LAS Library; Temp 20 Location: 156-004 Soil 4 S GAMMA SPEC LAL-0064 Soil 4 S RAD PERCENT SOLIDS	E-37	23-SEP-97	01-OCT-97	08-OCT-97
L10639-4 GS=LAS Library; Temp 20 Location: 156-004 Soil 4 S GAMMA SPEC LAL-0064 Soil 4 S RAD PERCENT SOLIDS	12-WS-07-IS2638ML	24-SEP-97	01-OCT-97	08-OCT-97
L10639-5 GS=LAS Library; Temp 20 Location: 156-004 Soil 4 S GAMMA SPEC LAL-0064 Soil 4 S RAD PERCENT SOLIDS	E-47	29-SEP-97	01-OCT-97	08-OCT-97
L10639-6 GS=LAS Library; Temp 20 Location: 156-004 Soil 4 S GAMMA SPEC LAL-0064 Soil 4 S RAD PERCENT SOLIDS	E-48	29-SEP-97	01-OCT-97	08-OCT-97
L10639-7 GS=LAS Library; Temp 20 Location: 156-004 Soil 4 S GAMMA SPEC LAL-0064 Soil 4 S RAD PERCENT SOLIDS	E-49	29-SEP-97	01-OCT-97	08-OCT-97
L10639-8 Location: Water 1 S EDD - DISK DEL.	REPORT TYPE	01-OCT-97	01-OCT-97	08-OCT-97

1001784

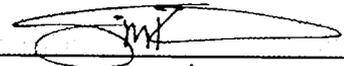
LAS LABORATORIES  
LOGIN CHAIN OF CUSTODY REPORT (ln01)  
Oct 02 1997, 10:23 am

Login Number: L10639  
Account: 784 Kemron Environmental Svcs., Marietta, OH  
Project: LANL RAD ANALYSES Radiological Analyses

Laboratory	Client	Collect	Receive	Due
Sample Number	Sample Number	Date	Date	PR Date
Water	1 S MORALES			
Water	1 S RAD RPT TYPE 4			

Page 2

Signature: \_\_\_\_\_



Date: \_\_\_\_\_

10/2/97

1001784

LAS Laboratories  
 SAMPLE SUMMARY REPORT (su02 S1)  
 Kemron Environmental Svcs., Marietta, OH

Client Sample Number	LAL Sample Number	SDS Number	Matrix	Method
12-WS-06-26464 ✓	L10639-1 L10639-1		Soil ✓ Soil ✓	GAMMA SPEC LAL-00 RAD PERCENT SOLII
12-WS-07-IS2638ML ✓	L10639-4 L10639-4		Soil ✓ Soil ✓	GAMMA SPEC LAL-00 RAD PERCENT SOLII
E-36 ✓	L10639-2 L10639-2		Soil ✓ Soil ✓	GAMMA SPEC LAL-00 RAD PERCENT SOLII
E-37 ✓	L10639-3 L10639-3		Soil ✓ Soil ✓	GAMMA SPEC LAL-00 RAD PERCENT SOLII
E-47 ✓	L10639-5 L10639-5		Soil ✓ Soil ✓	GAMMA SPEC LAL-00 RAD PERCENT SOLII
E-48 ✓	L10639-6 L10639-6		Soil ✓ Soil ✓	GAMMA SPEC LAL-00 RAD PERCENT SOLII
E-49 ✓	L10639-7 L10639-7		Soil ✓ Soil ✓	GAMMA SPEC LAL-00 RAD PERCENT SOLII
REPORT TYPE	L10639-8 L10639-8 ✓ L10639-8		Water Water Water	EDD - DISK DEL. ✓ MORALES ✓ RAD RPT TYPE 4 ✓

(001784

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH

Project Name: LANL RAD ANALYSES

Project Desc: Radiological Analyses

Client Sample ID: E-47  
Date Collected: 29-SEP-97  
Matrix: Soil

Login Number: L10639  
Date Received: 01-OCT-97  
Percent Solids: 85.33

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	54255	0.148	0.10	0.16		pCi/g	04-OCT-97	L10639-5
Bi-212	LAL-0064	54255	0.14	0.15	0.23		pCi/g	04-OCT-97	L10639-5
Bi-214	LAL-0064	54255	0.169	0.066	0.075		pCi/g	04-OCT-97	L10639-5
Co-57	LAL-0064	54255	-0.001	0.016	0.022		pCi/g	04-OCT-97	L10639-5
Co-60	LAL-0064	54255	-0.0189	0.0097	0.041		pCi/g	04-OCT-97	L10639-5
Cs-134	LAL-0064	54255	-0.003	0.015	0.032		pCi/g	04-OCT-97	L10639-5
Cs-137	LAL-0064	54255	1.21	0.15	0.037		pCi/g	04-OCT-97	L10639-5
K-40	LAL-0064	54255	0.52	0.32	0.34		pCi/g	04-OCT-97	L10639-5
Pb-210	LAL-0064	54255	1.0	1.6	2.5		pCi/g	04-OCT-97	L10639-5
Pb-212	LAL-0064	54255	0.199	0.054	0.058		pCi/g	04-OCT-97	L10639-5
Pb-214	LAL-0064	54255	0.138	0.056	0.077		pCi/g	04-OCT-97	L10639-5
Ra-226(GAMMA)	LAL-0064	54255	0.33	0.50	0.74		pCi/g	04-OCT-97	L10639-5
Th-234	LAL-0064	54255	0.12	0.41	0.71		pCi/g	04-OCT-97	L10639-5
Tl-208	LAL-0064	54255	0.066	0.033	0.036		pCi/g	04-OCT-97	L10639-5
U-235(GAMMA)	LAL-0064	54255	0.07	0.12	0.19		pCi/g	04-OCT-97	L10639-5

10/01/97

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH  
Project Name: LANL RAD ANALYSES  
Project Desc: Radiological Analyses

Client Sample ID: E-48  
Date Collected: 29-SEP-97  
Matrix: Soil

Login Number: L10639  
Date Received: 01-OCT-97  
Percent Solids: 87.26

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	54255	0.182	0.091	0.15		pCi/g	04-OCT-97	L10639-6
Bi-212	LAL-0064	54255	0.09	0.18	0.24		pCi/g	04-OCT-97	L10639-6
Bi-214	LAL-0064	54255	0.177	0.061	0.063		pCi/g	04-OCT-97	L10639-6
Co-57	LAL-0064	54255	-0.006	0.012	0.021		pCi/g	04-OCT-97	L10639-6
Co-60	LAL-0064	54255	0.013	0.013	0.032		pCi/g	04-OCT-97	L10639-6
Cs-134	LAL-0064	54255	0.004	0.012	0.027		pCi/g	04-OCT-97	L10639-6
Cs-137	LAL-0064	54255	0.87	0.11	0.034		pCi/g	04-OCT-97	L10639-6
K-40	LAL-0064	54255	1.07	0.40	0.39		pCi/g	04-OCT-97	L10639-6
Pb-210	LAL-0064	54255	0	1.6	2.5		pCi/g	04-OCT-97	L10639-6
Pb-212	LAL-0064	54255	0.240	0.056	0.057		pCi/g	04-OCT-97	L10639-6
Pb-214	LAL-0064	54255	0.211	0.057	0.073		pCi/g	04-OCT-97	L10639-6
Ra-226(GAMMA)	LAL-0064	54255	0.27	0.47	0.70		pCi/g	04-OCT-97	L10639-6
Th-234	LAL-0064	54255	0.50	0.40	0.65		pCi/g	04-OCT-97	L10639-6
Tl-208	LAL-0064	54255	0.085	0.033	0.034		pCi/g	04-OCT-97	L10639-6
U-235(GAMMA)	LAL-0064	54255	-0.014	0.10	0.17		pCi/g	04-OCT-97	L10639-6

10/01/97

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH  
Project Name: LANL RAD ANALYSES  
Project Desc: Radiological Analyses

Client Sample ID: E-49  
Date Collected: 29-SEP-97  
Matrix: Soil

Login Number: L10639  
Date Received: 01-OCT-97  
Percent Solids: 86.04

Isotope	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	54255	0.300	0.067	0.075		pCi/g	04-OCT-97	L10639-7
Bi-212	LAL-0064	54255	0.20	0.11	0.12		pCi/g	04-OCT-97	L10639-7
Bi-214	LAL-0064	54255	0.204	0.046	0.050		pCi/g	04-OCT-97	L10639-7
Co-57	LAL-0064	54255	0.002	0.013	0.022		pCi/g	04-OCT-97	L10639-7
Co-60	LAL-0064	54255	0.0075	0.0073	0.016		pCi/g	04-OCT-97	L10639-7
Cs-134	LAL-0064	54255	0.0003	0.0093	0.020		pCi/g	04-OCT-97	L10639-7
Cs-137	LAL-0064	54255	3.29	0.34	0.024		pCi/g	04-OCT-97	L10639-7
K-40	LAL-0064	54255	0.99	0.26	0.23		pCi/g	04-OCT-97	L10639-7
Pb-210	LAL-0064	54255	3.	19.	27.		pCi/g	04-OCT-97	L10639-7
Pb-212	LAL-0064	54255	0.283	0.051	0.050		pCi/g	04-OCT-97	L10639-7
Pb-214	LAL-0064	54255	0.243	0.048	0.058		pCi/g	04-OCT-97	L10639-7
Ra-226(GAMMA)	LAL-0064	54255	0.31	0.41	0.59		pCi/g	04-OCT-97	L10639-7
Th-234	LAL-0064	54255	0.47	0.47	0.68		pCi/g	04-OCT-97	L10639-7
Tl-208	LAL-0064	54255	0.084	0.025	0.027		pCi/g	04-OCT-97	L10639-7
U-235(GAMMA)	LAL-0064	54255	0.12	0.11	0.16		pCi/g	04-OCT-97	L10639-7

10/1/97



# ***LAS Laboratories, Inc.***

**KEMRON ENVIRONMENTAL SERVICES**

**ANALYTICAL DATA REPORT**

**FOR**

**GAMMA SPECTROMETRY**

LOG-IN NUMBER	<u>L10792</u>
QUOTATION NUMBER	<u>Q706259A</u>
DOCUMENT FILE NUMBER	<u>1021784</u>

**OFFICIAL RECORD COPY ML 10**

LAS LABORATORIES, INC. • 975 Kelly Johnson Drive • Las Vegas, Nevada 89119-3705 **1 2 5 6 9 9**  
Telephone 702-361-0220 • Facsimile 702-361-8146



November 7, 1997

Ms. Pat Lane  
Kemron Environmental Services  
109 Starlite Park  
Marietta, OH 45750

RE:    **Log-in No.**                    **L10792**  
      **Quotation No.**            **Q706259A**  
      **Document File No.**       **1021784**

The attached data report contains the analytical results of samples that were submitted to LAS Laboratories, Inc. on October 21, 1997. The temperature of the cooler upon receipt was 19°C. All sample containers coincided with the chain-of-custody documentation. All sample containers were received intact. Samples were received in time to meet the analytical holding time requirements. All discrepancies (if applicable) identified upon receipt of the samples have been forwarded to the client and are documented in the enclosed chain-of-custody records. (See attached Sample Receiving Checklist for details).

The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Jimmy Morales at (702) 361-3955, ext. 274. If you are unable to contact the client services representative, please call Daniel Fischer, client services manager, at extension 240.

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

Sincerely,

Jimmy A. Morales  
Client Services Representative

cc:    **Client Services**  
      **Document Control**

## CASE NARRATIVE RADIOCHEMICAL ANALYSES

The routine calibration and quality control (QC) analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, matrix spike samples, and duplicate samples.

### **Holding Time Requirements**

All holding time requirements were met.

### **Gamma Spectrometry**

#### *Analytical Method Gamma Spectrometry*

The gamma spectrometry analysis was performed using standard operating procedure, LAL-91-SOP-0064. The samples were analyzed in workgroup 54909. The instrument calibration verification met criteria. The method blank result for Bi-214 was slightly above the minimum detectable activity but below the reporting detection limits. The laboratory control sample recoveries were within QC criteria. The duplicate recoveries were within QC criteria. No re-analyses were performed.

Lydia M. Coleman  
Prepared By

November 5, 1997  
Date

**LAS Laboratories, Inc.**  
**DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES**  
*[Revised 04/05/96]*

<b>For Use on the Analytical Data Reporting Forms</b>	
<b>B</b>	Any constituent that was detected in the associated method blank at a concentration was greater than the reporting detection limit (RDL).
<b>C</b>	The minimum detectable activity exceeded the RDL due to the residue weight limitations forcing a volume reduction.
<b>D</b>	Constituent detected in the diluted sample.
<b>E</b>	Constituent concentration exceeded the calibration or attenuation curve range.
<b>F</b>	<i>For Alpha Spectrometry Only</i> -- Full width half max exceeded the acceptance limits.
<b>H</b>	Sample analysis performed outside of method-specified maximum holding time requirement.
<b>Y</b>	Chemical yield exceeded acceptance limits.
<b>For Use on the QC Data Reporting Forms</b>	
<b>*</b>	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
<b>a<sup>1</sup></b>	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
<b>b<sup>1</sup></b>	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

<sup>1</sup> Used as foot note designations on the QC summary form.

LAS LABORATORIES  
 LOGIN CHAIN OF CUSTODY REPORT (ln01)  
 Oct 21 1997, 06:13 pm

Login Number: L10792  
 Account: 784 Kemron Environmental Svcs., Marietta, OH  
 Project: MISC. ANALYSES

Laboratory Sample Number	Client Sample Number	Contact Date	Receive Date	Due PR Date
L10792-1 LAS LIBRARY, TEMP 19 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:28-FEB-98 Soil 4 S RAD PERCENT SOLIDS	12-WS-09-IS25710ML	01-SEP-97	21-OCT-97	28-OCT-97
L10792-2 LAS LIBRARY, TEMP 19 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:31-MAR-98 Soil 4 S RAD PERCENT SOLIDS	12-SS-09-06	02-OCT-97	21-OCT-97	28-OCT-97
L10792-3 LAS LIBRARY, TEMP 19 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:31-MAR-98 Soil 4 S RAD PERCENT SOLIDS	12-SS-08-06	02-OCT-97	21-OCT-97	28-OCT-97
L10792-4 LAS LIBRARY, TEMP 19 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:08-APR-98 Soil 4 S RAD PERCENT SOLIDS	12-WS-13-IS26116ML	10-OCT-97	21-OCT-97	28-OCT-97
L10792-5 LAS LIBRARY, TEMP 19 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:05-APR-98 Soil 4 S RAD PERCENT SOLIDS	12-WS-11-IS26289ML	07-OCT-97	21-OCT-97	28-OCT-97
L10792-6 LAS LIBRARY, TEMP 19 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:05-APR-98 Soil 4 S RAD PERCENT SOLIDS	12-BF-16-57101	07-OCT-97	21-OCT-97	28-OCT-97
L10792-7 LAS LIBRARY, TEMP 19 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:08-APR-98 Soil 4 S RAD PERCENT SOLIDS	K-58	10-OCT-97	21-OCT-97	28-OCT-97

1021784

LAS LABORATORIES  
 LOGIN CHAIN OF CUSTODY REPORT (ln01)  
 Oct 21 1997, 06:13 pm

Login Number: L10792  
 Account: 784 Kemron Environmental Svcs., Marietta, OH  
 Project: MISC. ANALYSES

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due Date
L10792-8 LAS LIBRARY, TEMP 19 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:08-APR-98 Soil 4 S RAD PERCENT SOLIDS	12-WS-08-IS25662ML	10-OCT-97	21-OCT-97	28-OCT-97
L10792-9 LAS LIBRARY, TEMP 19 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:01-APR-98 Soil 4 S RAD PERCENT SOLIDS	12-WS-10-IS26336ML	03-OCT-97	21-OCT-97	28-OCT-97
L10792-10 LAS LIBRARY, TEMP 19 Location: 157 Soil 4 S GAMMA SPEC LAL-0064 Hold:18-APR-98 Soil 4 S RAD PERCENT SOLIDS	12-BF-14-SP	20-OCT-97	21-OCT-97	28-OCT-97
L10792-11 Location: Water 1 S EDD - DISK DEL. Water 1 S MORALES Water 1 S RAD RPT TYPE 4	REPORT TYPE	21-OCT-97	21-OCT-97	28-OCT-97

Signature: Wally K  
 Date: 10/21/97  
 1021784



ENVIRONMENTAL SERVICES

CHAIN-OF-CUSTODY RECORD

L10792

03046

Project Contact: MR. T. REESE PHONE 410-671-6015 FAX 410-671-6018

Turn Around Requirements: 7 DAY TURN AROUND

Project No.: Project Name: WESTWOOD RADIOACTIVE MATERIALS DISPOSAL FACILITY

Sampler (print): FREDERICK L. ANSEL Signature: [Signature]

Sample I.D. No.	Comp	Grab	Date	Time	Protocol	
					CWA	SW846
12-BF-14-SP	✓		20 Oct 97	1020		

NUMBER OF SAMPLES	Hold	GAMMA SPEC

ADDITIONAL REQUIREMENTS (

Relinquished by: (Signature)	Date	Time	Received by: [Signature] 10-21-97	Relinquished by: (Signature)	Date	Time	Received by: (Signature)
------------------------------	------	------	-----------------------------------	------------------------------	------	------	--------------------------

Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Remarks:
------------------------------	------	------	---	------	------	----------

Homogenize all composite samples prior to analysis



LAS LABORATORIES, INC.

Sample Receiving Checklist

Client Name:

KEMRON

Job No:

210792

Cooler ID:

Page \_\_\_ of \_\_\_

132107

**COOLER CONDITION UPON RECEIPT**

Temperature of cooler upon receipt: 19°C

temperature of temp. blank upon receipt:

	yes	no	n/a	*Comments/Discrepancies
custody seals present	✓			
custody seals intact	✓			
chain of custody present	✓			
blue ice(or equiv.)present		✓		
blue ice(or equiv.)frozen			✓	
rad survey completed	✓			

**SAMPLE CONDITION UPON RECEIPT**

	yes	no	n/a	*Comments/Discrepancies
all bottles labeled	✓			
bottle custody seal present		✓		
bottle custody seal intact			✓	
samples intact	✓			
proper container used for sample	✓			
sample volume sufficient for analysis	✓			
proper pres. indicated on the COC	✓			
VOA's contain headspace			✓	
are samples bi-phasic(if so, indicate sample ID's):			✓	

**MISCELLANEOUS ITEMS**

	yes	no	n/a	*Comments/Discrepancies
samples with short holding times		✓		
samples to subcontract		✓		

**ADDITIONAL COMMENTS/DISCREPANCIES**

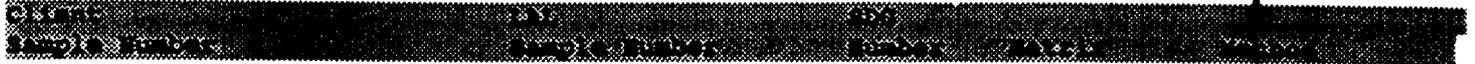
Completed by / date: [Signature] 10-21-97

sent to the client (date/initials): [Signature] \*\* Client's signature upon receipt:

Notes: \* = contact the appropriate CSR of any discrepancies immediately upon receipt

\*\* = please review this information and return via facsimile to the appropriate CSR (702)361-8146

LAS Laboratories  
 SAMPLE SUMMARY REPORT (su02 S1)  
 Kearon Environmental Svcs., Marietta, OH



12-BF-14-SP	L10792-10 L10792-10	Soil Soil	GAMMA SPEC LAL- RAD PERCENT SOL
12-BF-16-57101	L10792-6 L10792-6	Soil Soil	GAMMA SPEC LAL- RAD PERCENT SOI
12-SS-08-06	L10792-3 L10792-3	Soil Soil	GAMMA SPEC LAL- RAD PERCENT SOI
12-SS-09-06	L10792-2 L10792-2	Soil Soil	GAMMA SPEC LAL- RAD PERCENT SOL
12-WS-08-IS25662ML	L10792-8 L10792-8	Soil Soil	GAMMA SPEC LAL- RAD PERCENT SOL
12-WS-09-IS25710ML	L10792-1 L10792-1	Soil Soil	GAMMA SPEC LAL- RAD PERCENT SOL
12-WS-10-IS26336ML	L10792-9 L10792-9	Soil Soil	GAMMA SPEC LAL- RAD PERCENT SOL
12-WS-11-IS26289ML	L10792-5 L10792-5	Soil Soil	GAMMA SPEC LAL- RAD PERCENT SOL
12-WS-13-IS26116ML	L10792-4 L10792-4	Soil Soil	GAMMA SPEC LAL- RAD PERCENT SOL
E-58	L10792-7 L10792-7	Soil Soil	GAMMA SPEC LAL- RAD PERCENT SOL
REPORT TYPE	L10792-11 L10792-11 L10792-11	Water Water Water	EDD - DISK DEL. MORALES RAD RPT TYPE 4

1021784

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Mount Name: Kemron Environmental Svcs., Marietta, OH  
Project Name: MISC. ANALYSES  
Project Desc:

Client Sample ID: 12-SS-09-06  
Date Collected: 02-OCT-97  
Matrix: Soil

Login Number: L10792  
Date Received: 21-OCT-97  
Percent Solids: 96.25

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	54909	0.35	0.11	0.12		pCi/g	23-OCT-97	L10792-2
Bi-212	LAL-0064	54909	0.26	0.20	0.23		pCi/g	23-OCT-97	L10792-2
Bi-214	LAL-0064	54909	0.166	0.066	0.087		pCi/g	23-OCT-97	L10792-2
Co-57	LAL-0064	54909	-0.011	0.015	0.031		pCi/g	23-OCT-97	L10792-2
Co-60	LAL-0064	54909	0.050	0.020	0.031		pCi/g	23-OCT-97	L10792-2
Cs-134	LAL-0064	54909	0.013	0.019	0.035		pCi/g	23-OCT-97	L10792-2
Cs-137	LAL-0064	54909	8.37	0.86	0.042		pCi/g	23-OCT-97	L10792-2
K-40	LAL-0064	54909	1.81	0.47	0.33		pCi/g	23-OCT-97	L10792-2
Pb-210	LAL-0064	54909	2.6	1.9	2.8		pCi/g	23-OCT-97	L10792-2
Pb-212	LAL-0064	54909	0.312	0.071	0.080		pCi/g	23-OCT-97	L10792-2
Pb-214	LAL-0064	54909	0.305	0.078	0.11		pCi/g	23-OCT-97	L10792-2
Ra-226(GAMMA)	LAL-0064	54909	0.77	0.63	0.91		pCi/g	23-OCT-97	L10792-2
Th-234	LAL-0064	54909	0.73	0.46	0.75		pCi/g	23-OCT-97	L10792-2
Tl-208	LAL-0064	54909	0.109	0.040	0.046		pCi/g	23-OCT-97	L10792-2
U-235(GAMMA)	LAL-0064	54909	0.05	0.15	0.24		pCi/g	23-OCT-97	L10792-2

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH  
Subject Name: MISC. ANALYSES  
Project Desc:

Client Sample ID: 12-SS-08-06  
Date Collected: 02-OCT-97  
Matrix: Soil

Login Number: L10792  
Date Received: 21-OCT-97  
Percent Solids: 88.25

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	54909	0.257	0.058	0.068		pCi/g	23-OCT-97	L10792-3
Bi-212	LAL-0064	54909	0.07	0.11	0.15		pCi/g	23-OCT-97	L10792-3
Bi-214	LAL-0064	54909	0.193	0.042	0.044		pCi/g	23-OCT-97	L10792-3
Co-57	LAL-0064	54909	-0.0011	0.0087	0.019		pCi/g	23-OCT-97	L10792-3
Co-60	LAL-0064	54909	-0.0037	0.0066	0.016		pCi/g	23-OCT-97	L10792-3
Cs-134	LAL-0064	54909	0.0096	0.0087	0.017		pCi/g	23-OCT-97	L10792-3
Cs-137	LAL-0064	54909	1.54	0.16	0.017		pCi/g	23-OCT-97	L10792-3
K-40	LAL-0064	54909	1.33	0.28	0.21		pCi/g	23-OCT-97	L10792-3
Pb-210	LAL-0064	54909	2.	15.	22.		pCi/g	23-OCT-97	L10792-3
Pb-212	LAL-0064	54909	0.276	0.047	0.039		pCi/g	23-OCT-97	L10792-3
Pb-214	LAL-0064	54909	0.249	0.043	0.047		pCi/g	23-OCT-97	L10792-3
Ra-226(GAMMA)	LAL-0064	54909	0.18	0.34	0.47		pCi/g	23-OCT-97	L10792-3
Th-234	LAL-0064	54909	0.52	0.40	0.57		pCi/g	23-OCT-97	L10792-3
Tl-208	LAL-0064	54909	0.073	0.022	0.023		pCi/g	23-OCT-97	L10792-3
U-235(GAMMA)	LAL-0064	54909	0.053	0.093	0.15		pCi/g	23-OCT-97	L10792-3

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Count Name: Kemron Environmental Svcs., Marietta, OH

Subject Name: MISC. ANALYSES

Project Desc:

Client Sample ID: 12-BF-16-57101

Date Collected: 07-OCT-97

Matrix: Soil

Login Number: L10792

Date Received: 21-OCT-97

Percent Solids: 91.93

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	54909	0.355	0.10	0.11		pCi/g	23-OCT-97	L10792-6
Bi-212	LAL-0064	54909	0.21	0.21	0.27		pCi/g	23-OCT-97	L10792-6
Bi-214	LAL-0064	54909	0.194	0.069	0.089		pCi/g	23-OCT-97	L10792-6
Co-57	LAL-0064	54909	-0.007	0.011	0.025		pCi/g	23-OCT-97	L10792-6
Co-60	LAL-0064	54909	0.012	0.013	0.029		pCi/g	23-OCT-97	L10792-6
Cs-134	LAL-0064	54909	-0.015	0.015	0.031		pCi/g	23-OCT-97	L10792-6
Cs-137	LAL-0064	54909	3.28	0.35	0.038		pCi/g	23-OCT-97	L10792-6
K-40	LAL-0064	54909	1.40	0.43	0.34		pCi/g	23-OCT-97	L10792-6
Pb-210	LAL-0064	54909	2.9	1.9	2.6		pCi/g	23-OCT-97	L10792-6
Pb-212	LAL-0064	54909	0.367	0.066	0.054		pCi/g	23-OCT-97	L10792-6
Pb-214	LAL-0064	54909	0.236	0.067	0.090		pCi/g	23-OCT-97	L10792-6
Ra-226(GAMMA)	LAL-0064	54909	0.49	0.55	0.80		pCi/g	23-OCT-97	L10792-6
Th-234	LAL-0064	54909	0.45	0.43	0.71		pCi/g	23-OCT-97	L10792-6
Tl-208	LAL-0064	54909	0.056	0.036	0.047		pCi/g	23-OCT-97	L10792-6
U-235(GAMMA)	LAL-0064	54909	-0.122	0.088	0.23		pCi/g	23-OCT-97	L10792-6

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Client Name: Kemron Environmental Svcs., Marietta, OH

Project Name: MISC. ANALYSES

Project Desc:

Client Sample ID: 12-BF-14-SP

Date Collected: 20-OCT-97

Matrix: Soil

Login Number: L10792

Date Received: 21-OCT-97

Percent Solids: 96.5

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	54909	0.81	0.16	0.17		pCi/g	23-OCT-97	L10792-10
Bi-212	LAL-0064	54909	0.47	0.27	0.33		pCi/g	23-OCT-97	L10792-10
Bi-214	LAL-0064	54909	0.570	0.10	0.088		pCi/g	23-OCT-97	L10792-10
Co-57	LAL-0064	54909	0.003	0.013	0.022		pCi/g	23-OCT-97	L10792-10
Co-60	LAL-0064	54909	0	0.017	0.034		pCi/g	23-OCT-97	L10792-10
Cs-134	LAL-0064	54909	0.01	0.018	0.032		pCi/g	23-OCT-97	L10792-10
Cs-137	LAL-0064	54909	1.71	0.20	0.046		pCi/g	23-OCT-97	L10792-10
K-40	LAL-0064	54909	5.95	0.96	0.35		pCi/g	23-OCT-97	L10792-10
Pb-210	LAL-0064	54909	0.95	0.64	0.90		pCi/g	23-OCT-97	L10792-10
Pb-212	LAL-0064	54909	0.722	0.10	0.067		pCi/g	23-OCT-97	L10792-10
Pb-214	LAL-0064	54909	0.583	0.089	0.085		pCi/g	23-OCT-97	L10792-10
Ra-226(GAMMA)	LAL-0064	54909	0.18	0.55	0.76		pCi/g	23-OCT-97	L10792-10
Th-234	LAL-0064	54909	0.64	0.34	0.58		pCi/g	23-OCT-97	L10792-10
Tl-208	LAL-0064	54909	0.280	0.055	0.041		pCi/g	23-OCT-97	L10792-10
U-235(GAMMA)	LAL-0064	54909	0.08	0.13	0.21		pCi/g	23-OCT-97	L10792-10



# ***LAS Laboratories, Inc.***

**KEMRON ENVIRONMENTAL SERVICES**

**ANALYTICAL DATA REPORT**

**FOR**

**GAMMA SPECTROMETRY**

LOG-IN NUMBER	<u>L11025</u>
QUOTATION NUMBER	<u>Q706259-A-7DAY</u>
DOCUMENT FILE NUMBER	<u>1113784</u>



November 25, 1997

Ms. Pat Lane  
Kemron Environmental Services  
109 Starlite Park  
Marietta, OH 45750

**RE: Log-in No: L11025**  
**Quotation No: Q706259-A-7DAY**  
**Document File No: 1113784**

The attached data report contains the analytical results of samples that were submitted to LAS Laboratories, Inc. on November 13, 1997. The temperature of the cooler upon receipt was 19°C. All sample containers coincided with the chain-of-custody documentation. All sample containers were received intact. Samples were received in time to meet the analytical holding time requirements. All discrepancies (if applicable) identified upon receipt of the samples have been forwarded to the client and are documented in the enclosed chain-of-custody records. (See attached Sample Receiving Checklist for details).

The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Dawn M. Siekerman at (702) 361-3955, ext 272. If you are unable to contact the Client Services Representative, please call Mary B. Ford, Acting Client Services Manager, at extension 326.

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

Sincerely,

A handwritten signature in cursive script that reads "Dawn M. Siekerman".

Dawn M. Siekerman  
Project Manager

cc: Client Services  
Document Control

**CASE NARRATIVE  
RADIOCHEMICAL ANALYSES**

The routine calibration and quality control (QC) analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, matrix spike samples, and duplicate samples.

**Holding Time Requirements**

All holding time requirements were met.

**Gamma Spectrometry**

*Analytical Method Gamma Spectrometry*

The gamma spectrometry analysis was performed using standard operating procedure, LAL-91-SOP-0064. The samples were analyzed in workgroup 56077. The instrument calibration verification met criteria. The method blank results were within QC criteria, with the exception of bismuth-214, lead-210 and lead-214. This was attributed to the natural radon-222 in the air. The laboratory control sample recoveries were within QC criteria. The duplicate recoveries were within QC criteria. No re-analyses were performed.

Yvonne M. Jacoby  
Prepared By

November 24, 1997  
Date

**LAS Laboratories, Inc.**  
**DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES**  
*[Revised 04/05/96]*

<b>For Use on the Analytical Data Reporting Forms</b>	
<b>B</b>	Any constituent that was detected in the associated method blank at a concentration was greater than the reporting detection limit (RDL).
<b>C</b>	The minimum detectable activity exceeded the RDL due to the residue weight limitations forcing a volume reduction.
<b>D</b>	Constituent detected in the diluted sample.
<b>E</b>	Constituent concentration exceeded the calibration or attenuation curve range.
<b>F</b>	<i>For Alpha Spectrometry Only</i> -- Full width half max exceeded the acceptance limits.
<b>H</b>	Sample analysis performed outside of method-specified maximum holding time requirement.
<b>Y</b>	Chemical yield exceeded acceptance limits.
<b>For Use on the QC Data Reporting Forms</b>	
<b>*</b>	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
<b>a<sup>1</sup></b>	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
<b>b<sup>1</sup></b>	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

<sup>1</sup> Used as foot note designations on the QC summary form.

LAS LABORATORIES  
 LOGIN CHAIN OF CUSTODY REPORT (ln01)  
 Nov 13 1997, 03:47 pm

Login Number: L11025  
 Account: 784 Kemron Environmental Svcs., Marietta, OH  
 Project: MISC. ANALYSES

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L11025-1 Temp 19 Location: 157	12-BF-15-70/01	27-OCT-97	13-NOV-97	20-NOV-97
Soil 4	S GAMMA SPEC LAL-0064	Hold:25-APR-98		
Soil 4	S RAD PERCENT SOLIDS			
Soil 4	S RAD SCREEN	Hold:25-APR-98		
L11025-2 Temp 19 Location: 157	12-WS-17-MFU-1009	22-OCT-97	13-NOV-97	20-NOV-97
Soil 4	S GAMMA SPEC LAL-0064	Hold:20-APR-98		
Soil 4	S RAD PERCENT SOLIDS			
Soil 4	S RAD SCREEN	Hold:20-APR-98		
L11025-3 Temp 19 Location: 157	12-WS-18-MHFU-1004	30-OCT-97	13-NOV-97	20-NOV-97
Soil 4	S GAMMA SPEC LAL-0064	Hold:28-APR-98		
Soil 4	S RAD PERCENT SOLIDS			
Soil 4	S RAD SCREEN	Hold:28-APR-98		
L11025-4 Temp 19 Location: 157	12-WS-19-MHFU-1021	30-OCT-97	13-NOV-97	20-NOV-97
Soil 4	S GAMMA SPEC LAL-0064	Hold:28-APR-98		
Soil 4	S RAD PERCENT SOLIDS			
Soil 4	S RAD SCREEN	Hold:28-APR-98		
L11025-5 Temp 19 Location: 157	12-WS-20-I2512-FL	03-NOV-97	13-NOV-97	20-NOV-97
Soil 4	S GAMMA SPEC LAL-0064	Hold:02-MAY-98		
Soil 4	S RAD PERCENT SOLIDS			
Soil 4	S RAD SCREEN	Hold:02-MAY-98		
L11025-6 Temp 19 Location: 157	12-WS-21-IS25708ML	03-NOV-97	13-NOV-97	20-NOV-97
Soil 4	S GAMMA SPEC LAL-0064	Hold:02-MAY-98		
Soil 4	S RAD PERCENT SOLIDS			
Soil 4	S RAD SCREEN	Hold:02-MAY-98		

1113784

LAS LABORATORIES  
 LOGIN CHAIN OF CUSTODY REPORT (1n01)  
 Nov 13 1997, 03:47 pm

Login Number: L11025  
 Account: 784 Kemron Environmental Svcs., Marietta, OH  
 Project: MISC. ANALYSES

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L11025-7 Temp 19 Location: 157	12-WS-22-I2634ML	07-NOV-97	13-NOV-97	20-NOV-97
Soil 4	S GAMMA SPEC LAL-0064	Hold:06-MAY-98		
Soil 4	S RAD PERCENT SOLIDS			
Soil 4	S RAD SCREEN	Hold:06-MAY-98		
L11025-8 Temp 19 Location: 157	12-WS-23-I2685ML	06-NOV-97	13-NOV-97	20-NOV-97
Soil 4	S GAMMA SPEC LAL-0064	Hold:05-MAY-98		
Soil 4	S RAD PERCENT SOLIDS			
Soil 4	S RAD SCREEN	Hold:05-MAY-98		
L11025-9 Temp 19 Location: 157	12-WS-25-I2648ML	06-NOV-97	13-NOV-97	20-NOV-97
Soil 4	S GAMMA SPEC LAL-0064	Hold:05-MAY-98		
Soil 4	S RAD PERCENT SOLIDS			
Soil 4	S RAD SCREEN	Hold:05-MAY-98		
L11025-10 Location:	REPORT TYPE	13-NOV-97	13-NOV-97	20-NOV-97
Water 1	S EDD - DISK DEL.			
Water 1	S RAD RPT TYPE 4			
Water 1	S SIEKERMAN			

Signature: *Walt K 2*  
 Date: 11/13/97

1113784





**Sample Login  
Login Review Checklist**

Login Number 41025

The Login Review Checklist documents the review of the information entered into the ACS database for accuracy and useability. For effective login review, five items are necessary. They are the Chain of Custody (COC) (or equivalent), the Sample Summary Report (SSR), the Login COC Report, the Sample Receiving Checklist, and the Quote/COC Reconciliation Form. This checklist should be affixed to each login package prior to distribution.

**SAMPLE SUMMARY REPORT**

	<u>YES</u>	<u>NO</u>	<u>N/A</u>	<u>COMMENT</u>
1. Are all samples on the COC logged in or the proper discrepancies noted on the SSR?	x	—	—	_____
2. Are all Client Sample IDs logged in correctly?	x	—	—	_____
3. Are all matrices indicated correctly?	x	—	—	_____
4. Are all analyses on the COC logged in for appropriate samples?	x	—	—	_____
5. Are samples logged in for the proper products?	x	—	—	_____

**LOGIN CHAIN OF CUSTODY REPORT**

	<u>YES</u>	<u>NO</u>	<u>N/A</u>	<u>COMMENT</u>
1. Are the collect, receive, and due dates correct for every sample?	x	—	—	_____
2. Have all appropriate comments been included?	x	—	—	_____

**SAMPLE RECEIVING CHECKLIST**

	<u>YES</u>	<u>NO</u>	<u>N/A</u>	<u>COMMENT</u>
1. Are all discrepancies between the COC and login noted (if applicable)?	—	—	x	_____

**LOGIN pH CHECK (applicable projects only)**

	<u>YES</u>	<u>NO</u>	<u>N/A</u>	<u>COMMENT</u>
1. Has the pH of all aqueous samples been checked and the report attached?	—	—	x	_____

[Signature] 11-13-97  
Login Specialist signature date

[Signature] 11-13-97  
Secondary Reviewer signature date

[Signature] 11-14-97  
Project Management signature date

(KEMPOD)

Sample Receiving Checklist

Client Name: FOSTER SHELLER

Job No:

Cooler ID:

COOLER CONDITION UPON RECEIPT

Temperature of cooler upon receipt: 19°C

temperature of temp. blank upon receipt:

	yes	no	n/a	*Comments/Discrepancies
custody seals present		✓		
custody seals intact			✓	
chain of custody present	✓			
blue ice (or equiv.) present		✓		SEE STATEMENT BELOW
blue ice (or equiv.) frozen			✓	
rad survey completed	✓			

SAMPLE CONDITION UPON RECEIPT

	yes	no	n/a	*Comments/Discrepancies
all bottles labeled	✓			
bottle custody seal present		✓		
bottle custody seal intact			✓	
samples intact	✓			
proper container used for sample	✓			
sample volume sufficient for analysis	✓			
proper pres. indicated on the COC	✓			
VOA's contain headspace			✓	
are samples bi-phasic (if so, indicate sample ID's):			✓	

MISCELLANEOUS ITEMS

	yes	no	n/a	*Comments/Discrepancies
samples with short holding times		✓		
samples to subcontract		✓		

ADDITIONAL COMMENTS/DISCREPANCIES FOR RAD ANALYSIS ONLY. ✓

Completed by / date: Jan Red [Signature] 11/13/97

sent to the client (date/initials): [Signature] Client's signature upon receipt:

Notes: \* = contact the appropriate CSR of any discrepancies immediately upon receipt

\*\* = please review this information and return via facsimile to the appropriate CSR (702)361-8146

11278

LAS Laboratories  
 SAMPLE SUMMARY REPORT (su02 S1)  
 Kemron Environmental Svcs., Marietta, OH

Client Sample Number	LAL Sample Number	SDG Number	Matrix	Method
12-BF-15-70/01	L11025-1		Soil	GAMMA SPEC LAL-0
	L11025-1		Soil	RAD PERCENT SOLI
	L11025-1		Soil	RAD SCREEN
12-WS-17-MFU-1009	L11025-2		Soil	GAMMA SPEC LAL-0
	L11025-2		Soil	RAD PERCENT SOLI
	L11025-2		Soil	RAD SCREEN
12-WS-18-MHFU-1004	L11025-3		Soil	GAMMA SPEC LAL-0
	L11025-3		Soil	RAD PERCENT SOLI
	L11025-3		Soil	RAD SCREEN
12-WS-19-MHFU-1021	L11025-4		Soil	GAMMA SPEC LAL-0
	L11025-4		Soil	RAD PERCENT SOLI
	L11025-4		Soil	RAD SCREEN
12-WS-20-I2512-FL	L11025-5		Soil	GAMMA SPEC LAL-0
	L11025-5		Soil	RAD PERCENT SOLI
	L11025-5		Soil	RAD SCREEN
12-WS-21-IS25708ML	L11025-6		Soil	GAMMA SPEC LAL-0
	L11025-6		Soil	RAD PERCENT SOLI
	L11025-6		Soil	RAD SCREEN
12-WS-22-I2634ML	L11025-7		Soil	GAMMA SPEC LAL-0
	L11025-7		Soil	RAD PERCENT SOLI
	L11025-7		Soil	RAD SCREEN
12-WS-23-I2685ML	L11025-8		Soil	GAMMA SPEC LAL-0
	L11025-8		Soil	RAD PERCENT SOLI
	L11025-8		Soil	RAD SCREEN
12-WS-25-I2648ML	L11025-9		Soil	GAMMA SPEC LAL-0
	L11025-9		Soil	RAD PERCENT SOLI
	L11025-9		Soil	RAD SCREEN
REPORT TYPE	L11025-10		Water	EDD - DISK DEL.
	L11025-10		Water	RAD RPT TYPE 4
	L11025-10		Water	SIEKERMANN

111378

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH

Project Name: MISC. ANALYSES

Project Desc:

Client Sample ID: 12-BF-15-70/01

Date Collected: 27-OCT-97

Matrix: Soil

Login Number: L11025

Date Received: 13-NOV-97

Percent Solids: 93.1

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	56077	0.82	0.22	0.26		pCi/g	19-NOV-97	L11025-1
Bi-212	LAL-0064	56077	0.64	0.39	0.44		pCi/g	19-NOV-97	L11025-1
Bi-214	LAL-0064	56077	0.62	0.13	0.13		pCi/g	19-NOV-97	L11025-1
Co-57	LAL-0064	56077	0.008	0.020	0.034		pCi/g	19-NOV-97	L11025-1
Co-60	LAL-0064	56077	0.004	0.026	0.065		pCi/g	19-NOV-97	L11025-1
Cs-134	LAL-0064	56077	0.007	0.027	0.055		pCi/g	19-NOV-97	L11025-1
Cs-137	LAL-0064	56077	8.22	0.85	0.071		pCi/g	19-NOV-97	L11025-1
K-40	LAL-0064	56077	5.3	1.0	0.71		pCi/g	19-NOV-97	L11025-1
Pb-210	LAL-0064	56077	0.67	0.93	1.3		pCi/g	19-NOV-97	L11025-1
Pb-212	LAL-0064	56077	0.82	0.13	0.12		pCi/g	19-NOV-97	L11025-1
Pb-214	LAL-0064	56077	0.71	0.13	0.15		pCi/g	19-NOV-97	L11025-1
Ra-226(GAMMA)	LAL-0064	56077	1.7	1.1	1.5		pCi/g	19-NOV-97	L11025-1
Th-234	LAL-0064	56077	0.89	0.59	1.0		pCi/g	19-NOV-97	L11025-1
Tl-208	LAL-0064	56077	0.266	0.071	0.070		pCi/g	19-NOV-97	L11025-1
U-235(GAMMA)	LAL-0064	56077	0.09	0.23	0.33		pCi/g	19-NOV-97	L11025-1



# *LAS Laboratories, Inc.*

**KEMRON ENVIRONMENTAL SERVICES**

**ANALYTICAL DATA REPORT**

**FOR**

**GAMMA SPECTROMETRY**

LOG-IN NUMBER	<u>L11152</u>
QUOTATION NUMBER	<u>Q706259A</u>
DOCUMENT FILE NUMBER	<u>1204784</u>



December 17, 1997

Ms. Pat Lane  
Kemron Environmental Services  
109 Starlite Park  
Marietta, OH 45750

RE:    **Log-in No:**            **L11152**  
       **Quotation No:**       **Q706259A**  
       **Document File No:**   **1204784**

The attached data report contains the analytical results of samples that were submitted to LAS Laboratories, Inc. on 4 December 1997. The temperature of the cooler upon receipt was 19°C. All sample containers coincided with the chain-of-custody documentation. All sample containers were received intact. Samples were received in time to meet the analytical holding time requirements. All discrepancies (if applicable) identified upon receipt of the samples have been forwarded to the client and are documented in the enclosed chain-of-custody records. (See attached Sample Receiving Checklist for details).

The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Dawn M. Siekerman at (702) 361-3955, ext 272. If you are unable to contact the Client Services Representative, please call Mary B. Ford, Acting Client Services Manager, at extension 326.

Release of this data report has been authorized by the Laboratory Director or the Director's designee as evidenced by the following signature.

Sincerely,

Dawn M. Siekerman  
Project Manager

cc:    Client Services  
       Document Control

**CASE NARRATIVE  
RADIOCHEMICAL ANALYSES**

The routine calibration and quality control (QC) analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, matrix spike samples, and duplicate samples.

**Holding Time Requirements**

All holding time requirements were met.

**Gamma Spectrometry**

*Analytical Method Gamma Spectrometry*

The gamma spectrometry analysis was performed using standard operating procedure, LAL-91-SOP-0064. The samples were analyzed in workgroup 56648. The instrument calibration verification met criteria. The method blank results were within QC criteria. The laboratory control sample recoveries were within QC criteria. The duplicate recoveries were within QC criteria. No re-analyses were performed.

Yvonne M. Jacoby  
Prepared By

December 16, 1997  
Date

**LAS Laboratories, Inc.**  
**DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES**  
*[Revised 04/05/96]*

<b>For Use on the Analytical Data Reporting Forms</b>	
B	Any constituent that was detected in the associated method blank at a concentration was greater than the reporting detection limit (RDL).
C	The minimum detectable activity exceeded the RDL due to the residue weight limitations forcing a volume reduction.
D	Constituent detected in the diluted sample.
E	Constituent concentration exceeded the calibration or attenuation curve range.
F	<i>For Alpha Spectrometry Only</i> -- Full width half max exceeded the acceptance limits.
H	Sample analysis performed outside of method-specified maximum holding time requirement.
Y	Chemical yield exceeded acceptance limits.
<b>For Use on the QC Data Reporting Forms</b>	
*	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
a <sup>1</sup>	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
b <sup>1</sup>	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

<sup>1</sup> Used as foot note designations on the QC summary form.

LAS LABORATORIES  
 LOGIN CHAIN OF CUSTODY REPORT (ln01)  
 Dec 04 1997, 03:14 pm

Login Number: L11152  
 Account: 784 Kemron Environmental Svcs., Marietta, OH  
 Project: LANL RAD ANALYSES Radiological Analyses

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L11152-1 Temp 19 Location: 157 Soil 4	12-WS-24-MHFU1020	13-NOV-97	04-DEC-97	11-DEC-97
	S GAMMA SPEC LAL-0064	Hold:12-MAY-98		
L11152-2 Temp 19 Location: 157 Soil 4	12-WS-26-I2939AL	07-NOV-97	04-DEC-97	11-DEC-97
	S GAMMA SPEC LAL-0064	Hold:06-MAY-98		
L11152-3 Temp 19 Location: 157 Soil 4	12-WS-27-I2638ML	18-NOV-97	04-DEC-97	11-DEC-97
	S GAMMA SPEC LAL-0064	Hold:17-MAY-98		
L11152-4 Temp 19 Location: 157 Soil 4	12-WS-28-I2910AL	19-NOV-97	04-DEC-97	11-DEC-97
	S GAMMA SPEC LAL-0064	Hold:18-MAY-98		
L11152-5 Temp 19 Location: 157 Soil 4	12-WS-29-I2009FL	19-NOV-97	04-DEC-97	11-DEC-97
	S GAMMA SPEC LAL-0064	Hold:18-MAY-98		
L11152-6 Temp 19 Location: 157 Soil 4	12-WS-30-IS25729ML	19-NOV-97	04-DEC-97	11-DEC-97
	S GAMMA SPEC LAL-0064	Hold:18-MAY-98		
L11152-7 Temp 19 Location: 157 Soil 4	12-WS-32-I2976ML	21-NOV-97	04-DEC-97	11-DEC-97
	S GAMMA SPEC LAL-0064	Hold:20-MAY-98		
L11152-8 Temp 19 Location: 157 Soil 4	12-WS-33-IS26273ML	24-NOV-97	04-DEC-97	11-DEC-97
	S GAMMA SPEC LAL-0064	Hold:23-MAY-98		
L11152-9 Temp 19 Location: 157 Soil 4	12-WS-34-I2696ML	24-NOV-97	04-DEC-97	11-DEC-97
	S GAMMA SPEC LAL-0064	Hold:23-MAY-98		

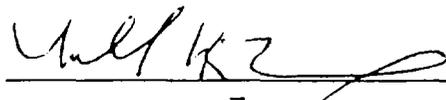
1204784

LAS LABORATORIES  
 LOGIN CHAIN OF CUSTODY REPORT (1n01)  
 Dec 04 1997, 03:14 pm

Login Number: L11152  
 Account: 784 Kemron Environmental Svcs., Marietta, OH  
 Project: LANL RAD ANALYSES Radiological Analyses

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L11152-10 Temp 19 Location: 157 Soil	12-BF-25-39101	02-DEC-97	04-DEC-97	11-DEC-97
	4 S GAMMA SPEC LAL-0064	Hold:01-MAY-98		
L11152-11 Temp 19 Location: 157 Soil	12-BF-26-40101	02-DEC-97	04-DEC-97	11-DEC-97
	4 S GAMMA SPEC LAL-0064	Hold:01-MAY-98		
L11152-12 Location:	REPORT TYPE	04-DEC-97	04-DEC-97	11-DEC-97
Water	1 S DEFAULT			
Water	1 S EDD - DISK DEL.			
Water	1 S RAD RPT TYPE 4			
Water	1 S SIEKERMANN			

Page 2

Signature:   
 Date: 1214197

1204784





L11152

### SAMPLE LOGIN REVIEW CHECKLIST

The Login Review Checklist documents the review of all information entered into the ACS database for accuracy and useability. For effective login review the following 5 documents are necessary: COC, Sample Summary Report, the Login COC Report, the Sample Receiving Checklist and the Quote/COC Reconciliation Form.

SAMPLE SUMMARY REPORT	YES	NO: Correction Taken
Are all samples on the COC logged into the database?	✓	
Are all Client Sample IDs logged in correctly?	✓	
Are all matrices logged in correctly?	✓	
Are all analyses indicated on the COC logged in for the appropriate sample?	✓	
Are all samples logged in for the appropriate method codes?	✓	
<b>LOGIN CHAIN OF CUSTODY REPORT</b>		
Are all the sample collection dates, received date and due date correct for all samples?	✓	
Have all appropriate comments been included in the comment section of the login COC report?	✓	
<b>SAMPLE RECEIVING CHECKLIST</b>		
Are all discrepancies (if applicable) between the COC and what was received noted on the checklist?	N/A	
<b>Ph VERIFICATION UPON RECEIPT</b>		
Have all aqueous samples been Ph verified for proper preservation requirements? (exceptions: VOC, H3, Radon)	N/A	
<b>IMMEDIATE CLIENT NOTIFICATION SCENARIOS</b>		<b>Has CSR Been Notified?</b>
Cooler Temperatures not within $2 \pm 4^{\circ}\text{C}$		N/A
Samples received after analytical holding time has expired or limited time remaining		↓ ✓
Samples received broken		
Samples received with improper preservation, container, insufficient sample volume		
Not all samples received that are indicated on the COC		

[Signature] 12-04-97  
(Login Specialist Signature: Date)

[Signature] 12/14/97  
(Secondary Reviewer Signature: Date)

[Signature]  
(Project Manager Signature: Date)

Sample Receiving Checklist

Client Name:

*Kemron*

LOGIN No:

*L1115Z*

Airbill/Cooler No:

**COOLER CONDITION UPON RECEIPT**

	yes	no	n/a	*Explain Temperature variance
Temperature of cooler upon receipt: <i>19°</i>				<i>RAD ANALYSES</i>
temperature of temp. blank upon receipt:				
				*Comments/Discrepancies
custody seals present	<input checked="" type="checkbox"/>			
custody seals intact	<input checked="" type="checkbox"/>			
chain of custody present and relinquished	<input checked="" type="checkbox"/>			
blue ice(or equiv.)present		<input checked="" type="checkbox"/>		
blue ice(or equiv.)frozen			<input checked="" type="checkbox"/>	
rad survey completed	<input checked="" type="checkbox"/>			

**SAMPLE CONDITION UPON RECEIPT**

	yes	no	n/a	*Comments/Discrepancies
all bottles labeled	<input checked="" type="checkbox"/>			
bottle custody seal present		<input checked="" type="checkbox"/>		
bottle custody seal intact			<input checked="" type="checkbox"/>	
<del>samples</del> Intact	<input checked="" type="checkbox"/>			
proper container used for sample	<input checked="" type="checkbox"/>			
sample volume sufficient for analysis	<input checked="" type="checkbox"/>			
proper pres. indicated on the container or COC	<input checked="" type="checkbox"/>			
VOA's contain headspace			<input checked="" type="checkbox"/>	
are samples bi-phasic(if so, indicate sample ID's):			<input checked="" type="checkbox"/>	

**MISCELLANEOUS ITEMS**

	yes	no	n/a	*Comments/Discrepancies
samples with short holding times		<input checked="" type="checkbox"/>		
samples to subcontract		<input checked="" type="checkbox"/>		

**ADDITIONAL COMMENTS/DISCREPANCIES**

Completed by / date:

*[Signature]* *12/04/97*

sent to the client (date/initials):

Client's signature upon receipt:

Notes: \* = contact the appropriate CSR of any discrepancies immediately upon receipt

\*\* = please review this information and return via facsimile to the appropriate CSR (702)361-8146

# LAS LABORATORIES

## RADIOCHEMISTRY DATA REPORT

Account Name: Kemron Environmental Svcs., Marietta, OH  
 Project Name: LANL RAD ANALYSES  
 Project Desc: Radiological Analyses

Client Sample ID: 12-BF-25-39101  
 Date Collected: 02-DEC-97  
 Matrix: Soil

Login Number: L11152  
 Date Received: 04-DEC-97

Constituent	Method	Batch	Activity	Error	MDA	Qualifier	Units	Analyzed	Lab ID
Ac-228	LAL-0064	56648	0.76	0.16	0.18		pCi/g	09-DEC-97	L11152-10
Bi-212	LAL-0064	56648	0.46	0.25	0.28		pCi/g	09-DEC-97	L11152-10
Bi-214	LAL-0064	56648	0.444	0.097	0.098		pCi/g	09-DEC-97	L11152-10
Co-57	LAL-0064	56648	0.002	0.021	0.031		pCi/g	09-DEC-97	L11152-10
Co-60	LAL-0064	56648	0.007	0.021	0.046		pCi/g	09-DEC-97	L11152-10
Cs-134	LAL-0064	56648	-0.004	0.022	0.047		pCi/g	09-DEC-97	L11152-10
Cs-137	LAL-0064	56648	12.4	1.3	0.054		pCi/g	09-DEC-97	L11152-10
K-40	LAL-0064	56648	5.35	0.93	0.44		pCi/g	09-DEC-97	L11152-10
Pb-210	LAL-0064	56648	0.74	0.87	1.3		pCi/g	09-DEC-97	L11152-10
Pb-212	LAL-0064	56648	0.77	0.12	0.10		pCi/g	09-DEC-97	L11152-10
Pb-214	LAL-0064	56648	0.55	0.11	0.14		pCi/g	09-DEC-97	L11152-10
Re-226(GAMMA)	LAL-0064	56648	1.59	0.79	1.1		pCi/g	09-DEC-97	L11152-10
Th-234	LAL-0064	56648	0.76	0.42	0.72		pCi/g	09-DEC-97	L11152-10
Tl-208	LAL-0064	56648	0.205	0.059	0.067		pCi/g	09-DEC-97	L11152-10
U-235(GAMMA)	LAL-0064	56648	0.00	0.00	0.30		pCi/g	09-DEC-97	L11152-10

**SAMPLES ANALYZED ON SITE**

Calibration Data  
IPL Standard : May 30, 1997

Energy: -17.308 1.034 0.000  
Shape: 29.178 0.021 0.000

Energy / FWHM Table

Channel	Energy(keV)	Fit(keV)	Delta	FWHM	Fit	Delta
656.68	661.66	661.63	0.00%	43.90	44.25	-0.80%
-1151.66	1173.24	1173.38	-0.01%	56.35	54.87	2.63%
1305.46	1332.50	1332.40	0.01%	57.04	58.17	-1.98%

Efficiency: 22.348 -14.906 2.294 0.000

Efficiency Table

Energy	Effic.	Fit	Delta
660.96	0.035633	0.035633	0.00%
1173.60	0.015976	0.015976	0.00%
1335.13	0.014603	0.014603	0.00%

9-4-97

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 27-Aug-97 06:39:17  
 Live Time: 1796.22  
 Analyzed: 27-Aug-97 07:30:11

Sample:  
 STANDARD DAILY TEST 8/27/97  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

| Peak Analysis |

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50	0.007	5.39 %	6697	1331.15	0.003
CO-60	1173.24	0.007	4.56 %	7583	1171.68	0.003
CS-137	661.66	0.023	1.11 %	47154	662.05	0.002
CD-109	88.03			0		4.297e-06
UNKNOWN				5564	114.07	
UNKNOWN				8195	199.56	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60	0.007	6.97
CS-137	0.023	2.23
CD-109		
	0.030	0.10

-----  
Analysis Report  
-----

Facility: Aberdeen  
Edgewood, MD  
Counted: 27-Aug-97 07:31:41  
Live Time: 1799.56  
Analyzed: 27-Aug-97 08:40:49

Sample:  
BACKGROUND 8/27/97  
Nuclide Library: C:\USER\JOE.LIB  
-----

-----  
Peak Analysis  
-----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		1.459e-04
CO-60	1173.24			0		1.431e-04
CS-137	661.66			0		1.006e-04
CD-109	88.03			0		1.229e-06

-----

-----  
Nuclide Summary  
-----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

-----

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 27-Aug-97 09:27:10  
 Live Time: 1799.06  
 Analyzed: 27-Aug-97 10:08:40

Sample:  
 CENTRAL PIPE C-01 ( 9708<sup>26</sup>27C1)  
 Nuclide Library: C:\USER\JOE.LIB

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		2.109e-04
CO-60	1173.24			0		1.948e-04
CS-137	661.66			0		1.708e-04
CD-109	88.03			0		2.440e-06
UNKNOWN				2219	234.76	
UNKNOWN				1032	347.94	
UNKNOWN				619	599.14	
UNKNOWN				1129	1456.73	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

1241 g  
 - 193 g  
 -----  
 1048 g

$< .17 \mu\text{Ci/g}$



Analysis Report

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 27-Aug-97 11:30:28  
 Live Time: 1798.92  
 Analyzed: 27-Aug-97 14:40:42

Sample:  
 CENTRAL PIPE C-03 ( 970826C3)  
 Nuclide Library: C:\USER\JOE.LIB

Peak Analysis

Nuclide	Library Energy	Activity $\mu\text{Ci}$	Uncertainty %	Area	Peak @ keV	MDA $\mu\text{Ci}$
CO-60	1332.50			0		2.183e-04
CO-60	1173.24			0		2.110e-04
CS-137	661.66			0		1.844e-04
CD-109	88.03			0		2.712e-06
UNKNOWN				2361	238.28	
UNKNOWN				967	348.20	
UNKNOWN				721	596.47	
UNKNOWN				1427	1455.88	

Nuclide Summary

Nuclide	Activity $\mu\text{Ci}$	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

$$\begin{array}{r} 1465g \\ - 193g \\ \hline 1272g \end{array}$$

$$< .15 \mu\text{Ci/g}$$

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 09-Sep-97 07:04:08  
 Live Time: 1796.06  
 Analyzed: 09-Sep-97 08:15:25

Sample:  
 STANDARD DAILY TEST (9-9-97)  
 Nuclide Library: C:\USER\JOE.LIB

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity μCi	Uncertainty %	Area	Peak @ keV	MDA μCi
CO-60	1332.50	0.007	5.32 %	7049	1327.27	0.003
CO-60	1173.24	0.007	4.57 %	7257	1168.93	0.003
CS-137	661.66	0.024	1.18 %	47364	661.46	0.002
CD-109	88.03			0		4.427e-06
UNKNOWN				6030	118.03	
UNKNOWN				11898	198.06	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity μCi	Error %
CO-60	0.007	6.94
CS-137	0.024	2.35
CD-109		
	0.031	0.10

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 09-Sep-97 08:16:36  
 Live Time: 1799.4  
 Analyzed: 09-Sep-97 08:49:11

Sample:  
 daily background check (9-9-97)  
 Nuclide Library: C:\USER\JOE.LIB

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity μCi	Uncertainty %	Area	Peak @ keV	MDA μCi
CO-60	1332.50			0		1.469e-04
CO-60	1173.24			0		1.407e-04
CS-137	661.66	7.669e-04	14.10 %	1547	666.05	6.393e-04
CD-109	88.03			0		1.603e-06

-----  
 Nuclide Summary  
 -----

Nuclide	Activity μCi	Error %
CO-60		
CS-137	7.669e-04	28.20
CD-109		
	7.669e-04	0.02

Analysis Report

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 09-Sep-97 08:52:40  
 Live Time: 1798.52  
 Analyzed: 09-Sep-97 09:27:45

Sample:  
 97-09-05-C-05 CENTER PIPE  
 Nuclide Library: C:\USER\JOE.LIB

Peak Analysis

Nuclide	Library Energy	Activity $\mu\text{Ci}$	Uncertainty %	Area	Peak @ keV	MDA $\mu\text{Ci}$
CO-60	1332.50			0		2.532e-04
CO-60	1173.24			0		2.352e-04
CS-137	661.66	7.219e-04	24.49 %	1455	665.39	0.001
CD-109	88.03			0		3.234e-06
UNKNOWN				2098	346.08	
UNKNOWN				1318	1453.70	

Nuclide Summary

Nuclide	Activity $\mu\text{Ci}$	Error %
CO-60		
CS-137	7.219e-04	48.98
CD-109		
	7.219e-04	0.04

$1536 \text{ g}$  gross  
 $- 193 \text{ g}$  container  


---

 $1343 \text{ g}$  net weight

$0.54 \text{ } \mu\text{Ci/gm}$   
 $< 0.74$

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 22-Sep-97 09:25:55  
 Live Time: 1796.22  
 Analyzed: 22-Sep-97 09:56:23

Sample:  
 STANDARD DAILY TEST 9/22/97  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

| Peak Analysis |

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50	0.007	5.57 %	6386	1328.83	0.003
CO-60	1173.24	0.007	4.95 %	7130	1170.72	0.003
CS-137	661.66	0.023	1.20 %	45836	662.09	0.001
CD-109	88.03			0		4.275e-06
UNKNOWN				5415	113.96	
UNKNOWN				10553	199.56	

| Nuclide Summary |

Nuclide	Activity $\mu$ Ci	Error %
CO-60	0.007	7.40
CS-137	0.023	2.39
CD-109		
	0.029	0.10

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 22-Sep-97 15:11:34  
 Live Time: 1799.34  
 Analyzed: 22-Sep-97 15:55:03

Sample:  
 97-09-19-e-C6 (UNDER SEPTIC TANK)  
 Nuclide Library: C:\USER\JOE.LIB

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		1.904e-04
CO-60	1173.24			0		1.655e-04
CS-137	661.66			0		1.303e-04
CD-109	88.03			0		1.969e-06
UNKNOWN				1390	225.88	
UNKNOWN				660	1425.51	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

10839  
 - 1939  
 -----  
 8909  
  
 < .146  $\mu$ Ci/g

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 29-Sep-97 06:45:54  
 Live Time: 1796.24  
 Analyzed: 29-Sep-97 08:13:46

Sample:  
 STANDARD DAILY TEST 9/29/97  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

| Peak Analysis |

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50	0.007	5.67 %	6524	1323.18	0.003
CO-60	1173.24	0.007	5.03 %	7324	1164.74	0.003
CS-137	661.66	0.023	1.14 %	46271	658.01	0.002
CD-109	88.03			0		4.285e-06
UNKNOWN				3827	116.21	
UNKNOWN				6193	196.34	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60	0.007	7.53
CS-137	0.023	2.28
CD-109		
	0.030	0.10

-----

Analysis Report

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 29-Sep-97 08:27:29  
 Live Time: 1799.52  
 Analyzed: 29-Sep-97 09:26:49

Sample:  
 background test 9/29/97  
 Nuclide Library: C:\USER\JOE.LIB

Peak Analysis

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		1.517e-04
CO-60	1173.24			0		1.411e-04
CS-137	661.66			0		1.071e-04
CD-109	88.03			0		1.357e-06

Nuclide Summary

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 29-Sep-97 14:15:39  
 Live Time: 1798.9  
 Analyzed: 29-Sep-97 14:58:45

Sample:  
 97-09-29-E-43 9/29/97 PIT SAMPLE EAST SE OF SILT FENCE 0-2'  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

| Peak Analysis |

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		2.555e-04
CO-60	1173.24			0		2.135e-04
CS-137	661.66			0		1.817e-04
CD-109	88.03			0		2.800e-06
UNKNOWN				620	581.90	
UNKNOWN				1368	1417.13	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

1810g  
 - 193g  
 -----  
 1617g

<0.11  $\mu$ Ci/g

Analysis Report

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 29-Sep-97 15:01:16  
 Live Time: 1798.92  
 Analyzed: 29-Sep-97 15:32:25

Sample:  
 97-09-29-E-44 9/29/97 PIT SAMPLE EAST SE OF SILT FENCE 2-4'  
 Nuclide Library: C:\USER\JOE.LIB

Peak Analysis

Nuclide	Library Energy	Activity $\mu\text{Ci}$	Uncertainty %	Area	Peak @ keV	MDA $\mu\text{Ci}$
CO-60	1332.50			0		2.548e-04
CO-60	1173.24			0		2.087e-04
CS-137	661.66			0		1.758e-04
CD-109	88.03			0		2.815e-06
UNKNOWN				1638	224.40	
UNKNOWN				1218	332.69	
UNKNOWN				1461	580.09	
UNKNOWN				1050	1411.66	

Nuclide Summary

Nuclide	Activity $\mu\text{Ci}$	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

1864 g  
 - 193 g  
 -----  
 1671 g

< .11  $\mu\text{Ci/g}$

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 29-Sep-97 12:30:20  
 Live Time: 1799.06  
 Analyzed: 29-Sep-97 13:00:39

Sample:  
 97-09-29-E-47 9/29/97 PIT SAMPLE  
 Nuclide Library: C:\USER\JOE.LIB

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		1.761e-04
CO-60	1173.24			0		1.598e-04
CS-137	661.66	0.003	4.51 %	6401	649.93	7.071e-04
CD-109	88.03			0		2.406e-06

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137	0.003	9.02
CD-109		
	0.003	0.03

2318g  
 - 193g  
 -----  
 2125

1.4  $\mu$ Ci/g

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 29-Sep-97 13:05:21  
 Live Time: 1799.18  
 Analyzed: 29-Sep-97 13:41:46

Sample:  
 97-09-29-E-48 9/29/97 PIT SAMPLE  
 Nuclide Library: C:\USER\JOE.LIB

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		1.740e-04
CO-60	1173.24			0		1.565e-04
CS-137	661.66	0.002	7.52 %	3246	650.38	7.531e-04
CD-109	88.03			0		2.252e-06
UNKNOWN				622	229.66	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137	0.002	15.05
CD-109		
	0.002	0.02

2248.5 g  
 - 193 g  
 -----  
 2055.5

$< 1.0 \mu\text{Ci/g}$  ( $0.97 \mu\text{Ci/g}$ )

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 29-Sep-97 13:43:10  
 Live Time: 1798.92  
 Analyzed: 29-Sep-97 14:13:31

Sample:  
 97-09-29-E-49 9/29/97 PIT SAMPLE  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

| Peak Analysis |

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		1.822e-04
CO-60	1173.24			0		1.601e-04
CS-137	661.66	0.005	2.90 %	9927	647.36	8.631e-04
CD-109	88.03			0		2.593e-06
UNKNOWN				818	228.20	

| Nuclide Summary |

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137	0.005	5.80
CD-109		
	0.005	0.03

*2069.5 g gross*  
*- 193*  


---

*1876.5 g net*  
  
*2.67  $\mu$ Ci/g*

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 30-Sep-97 06:23:24  
 Live Time: 1796.26  
 Analyzed: 30-Sep-97 07:01:10

Sample:  
 STANDARD DAILY TEST 9/30/97  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50	0.007	5.28 %	6620	1328.21	0.003
CO-60	1173.24	0.007	4.52 %	7940	1169.29	0.003
CS-137	661.66	0.023	1.16 %	46000	660.84	0.001
CD-109	88.03			0		4.239e-06
UNKNOWN				2576	112.10	
UNKNOWN				6657	200.87	

-----

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60	0.007	6.87
CS-137	0.023	2.31
CD-109		
	0.030	0.10

-----

Analysis Report

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 29-Sep-97 15:35:14  
 Live Time: 1798.46  
 Analyzed: 30-Sep-97 06:19:27

Sample: 97-09-29-E-45 9/29/97 PIT SAMPLE <sup>South</sup> EAST SE OF SILT FENCE0-2'  
 Nuclide Library: C:\USER\JOE.LIB

Peak Analysis

Nuclide	Library Energy	Activity $\mu\text{Ci}$	Uncertainty %	Area	Peak @ keV	MDA $\mu\text{Ci}$
CO-60	1332.50			0		2.415e-04
CO-60	1173.24			0		2.040e-04
CS-137	661.66			0		3.330e-04
CD-109	88.03			0		3.177e-06
UNKNOWN				4328	227.42	
UNKNOWN				13425	643.41	
UNKNOWN				1489	1408.43	

Nuclide Summary

Nuclide	Activity $\mu\text{Ci}$	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

1775g  
 -193g  
 -----  
 1582g

$\frac{21}{100} = 0.21 \mu\text{Ci/g}$

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 30-Sep-97 07:35:11  
 Live Time: 1795.88  
 Analyzed: 30-Sep-97 08:28:31

-----  
 Sample:  
 97-09-29-E-46 9/29/97 PIT SAMPLE SOUTH SE OF SILT FENCE 2-3'  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		2.252e-04
CO-60	1173.24			0		2.174e-04
CS-137	661.66	0.041	0.68 %	81698	662.41	0.001
CD-109	88.03			0		4.840e-06
UNKNOWN				11419	197.51	
UNKNOWN				2927	440.41	
UNKNOWN				1159	1457.35	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137	0.041	1.35
CD-109		
	0.041	0.05

1749g  
 -193g  
 -----  
 1556g

26.35  $\mu$ Ci/g

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 01-Oct-97 06:23:44  
 Live Time: 1796.24  
 Analyzed: 01-Oct-97 07:27:16

Sample:  
 STANDARD DAILY TEST 10/1/97  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

| Peak Analysis |

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50	0.007	5.58 %	6716	1342.15	0.003
CO-60	1173.24	0.007	4.80 %	6912	1181.50	0.002
CS-137	661.66	0.023	1.17 %	46565	667.72	0.002
CD-109	88.03			0		4.215e-06
UNKNOWN				2926	118.68	
UNKNOWN				8051	201.41	

| Nuclide Summary |

Nuclide	Activity $\mu$ Ci	Error %
CO-60	0.007	7.28
CS-137	0.023	2.34
CD-109		
	0.030	0.10

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 01-Oct-97 13:45:36  
 Live Time: 1798.98  
 Analyzed: 01-Oct-97 14:46:34

Sample:  
 97-10-1-E-52 TRENCH SAMPLE AT START OF TRENCH  
 Nuclide Library: C:\USER\JOE.LIB

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		1.914e-04
CO-60	1173.24			0		1.807e-04
CS-137	661.66	0.003	4.94 %	5157	658.30	8.931e-04
CD-109	88.03			0		2.596e-06
UNKNOWN				1853	231.62	
UNKNOWN				704	1443.69	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137	0.003	9.89
CD-109		
	0.003	0.03

2242g  
 - 193g  
 -----  
 2049g

1.5  $\mu$ Ci/g

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 02-Oct-97 09:09:48  
 Live Time: 1796.2  
 Analyzed: 02-Oct-97 09:45:33

Sample:  
 standard daily test 10/2/97  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50	0.007	6.00 %	6609	1343.43	0.004
CO-60	1173.24	0.006	5.39 %	6884	1182.03	0.002
CS-137	661.66	0.023	1.10 %	47073	668.54	0.001
CD-109	88.03			0		4.228e-06
UNKNOWN				4413	116.61	
UNKNOWN				8873	200.67	

-----

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60	0.007	8.02
CS-137	0.023	2.19
CD-109		
	0.030	0.10

-----

Analysis Report

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 02-Oct-97 09:46:59  
 Live Time: 1798.56  
 Analyzed: 02-Oct-97 13:01:48

Sample: 97-10-02-E-53 @ 40' into East pipe Trench

~~INFORMATIONAL SAMPLE EAST TRENCH~~ 10/2/97

Nuclide Library: C:\USER\JOE.LIB

Peak Analysis

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		1.877e-04
CO-60	1173.24			0		1.823e-04
CS-137	661.66	0.009	1.98 %	17707	666.04	8.960e-04
CD-109	88.03			0		2.810e-06
UNKNOWN				2800	221.24	

Nuclide Summary

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137	0.009	3.95
CD-109		
	0.009	0.03

1558  
 - 193  
 -----  
 1365

6.59  $\mu$ Ci/g

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 03-Oct-97 08:56:21  
 Live Time: 1796.2  
 Analyzed: 03-Oct-97 09:45:38

Sample:  
 STANDARD DAILY TEST 10/3/97  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

| Peak Analysis |

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50	0.007	6.01 %	6633	1345.26	0.004
CO-60	1173.24	0.006	5.42 %	6582	1184.82	0.002
CS-137	661.66	0.023	1.16 %	46204	669.00	0.002
CD-109	88.03			0		4.243e-06
UNKNOWN				2469	111.26	
UNKNOWN				8303	199.72	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60	0.006	8.06
CS-137	0.023	2.33
CD-109		
	0.029	0.11

-----

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 03-Oct-97 11:38:11  
 Live Time: 1799.18  
 Analyzed: 03-Oct-97 12:47:42

Sample: 97-10-03-E-55 (NOTHERN 7' DEEP @90' from headwall)  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		2.038e-04
CO-60	1173.24			0		1.936e-04
CS-137	661.66			0		1.579e-04
CD-109	88.03			0		2.203e-06
UNKNOWN				871	231.79	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

1771  
 - 193  
 -----  
 1578

< 0.1  $\mu$ Ci/g

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 03-Oct-97 12:49:50  
 Live Time: 1799.14  
 Analyzed: 03-Oct-97 13:25:52

Sample:  
 97-10-03-E-54 ( 7' DEEP @ 70' from headwall)  
 Nuclide Library: C:\USER\JOE.LIB

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		1.944e-04
CO-60	1173.24			0		1.868e-04
CS-137	661.66			0		1.685e-04
CD-109	88.03			0		2.351e-06
UNKNOWN				1190	226.89	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

1901.5g  
 - 193g  
 -----  
 1708.5g  
  
 < .099  $\mu$ Ci/g

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 06-Oct-97 06:36:03  
 Live Time: 1796.2  
 Analyzed: 06-Oct-97 08:46:36

Sample:  
 STANDARD DAILY TEST 10/6/97  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity µCi	Uncertainty %	Area	Peak @ keV	MDA µCi
CO-60	1332.50			0		5.129e-04
CO-60	1173.24			0		5.437e-04
CS-137	661.66	0.024	1.06 %	47806	654.35	0.002
CD-109	88.03			0		4.315e-06
UNKNOWN				3156	116.91	
UNKNOWN				9309	196.56	
UNKNOWN				7561	1156.76	
UNKNOWN				7450	1315.43	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity µCi	Error %
CO-60		
CS-137	0.024	2.11
CD-109		
	0.024	0.05

-----  
Analysis Report  
-----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 28-Aug-97 10:53:14  
 Live Time: 1798.82  
 Analyzed: 06-Oct-97 15:29:14

Sample:  
 970826C4  
 Nuclide Library: C:\USER\JOE.LIB

-----  
Peak Analysis  
-----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		2.368e-04
CO-60	1173.24			0		2.263e-04
CS-137	661.66			0		1.910e-04
CD-109	88.03			0		2.875e-06
UNKNOWN				2530	232.20	
UNKNOWN				1323	348.65	
UNKNOWN				1534	597.18	
UNKNOWN				1738	1458.67	

-----  
Nuclide Summary  
-----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

1508 g gross  
 - 193 tare  
 -----  
 1315 g net

< 0.145  $\mu$ g/g

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 16-Oct-97 06:27:17  
 Live Time: 1796.22  
 Analyzed: 16-Oct-97 07:00:20

Sample:  
 Standard Daily Tests 10-16-97  
 Nuclide Library: C:\USER\JOE.LIB  
 -----

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50	0.007	6.27 %	6390	1331.87	0.003
CO-60	1173.24	0.006	5.18 %	6877	1173.58	0.003
CS-137	661.66	0.023	1.09 %	46803	662.34	0.001
CD-109	88.03			0		4.245e-06
UNKNOWN				4670	117.47	
UNKNOWN				9916	198.33	

-----  
 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60	0.007	7.98
CS-137	0.023	2.18
CD-109		
	0.030	0.10

-----  
 Analysis Report  
 -----

Facility: Aberdeen  
 Edgewood, MD  
 Counted: 16-Oct-97 11:48:00  
 Live Time: 1798.74  
 Analyzed: 16-Oct-97 12:26:57

Sample:  
 97-10-16-E-63  
 Nuclide Library: C:\USER\JOE.LIB

-----  
 Peak Analysis  
 -----

Nuclide	Library Energy	Activity $\mu$ Ci	Uncertainty %	Area	Peak @ keV	MDA $\mu$ Ci
CO-60	1332.50			0		2.484e-04
CO-60	1173.24			0		2.384e-04
CS-137	661.66			0		1.890e-04
CD-109	88.03			0		3.077e-06
UNKNOWN				2522	230.57	
UNKNOWN				1162	344.50	
UNKNOWN				1775	593.61	
UNKNOWN				1379	1450.53	

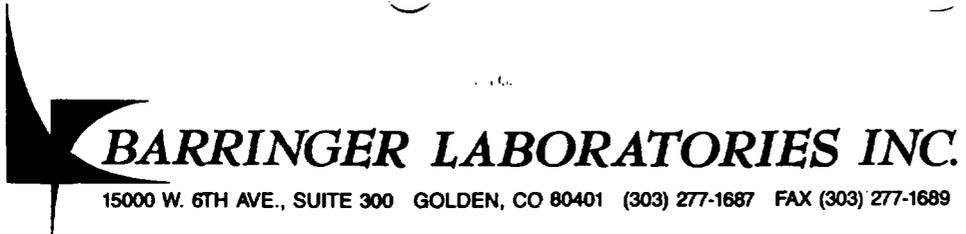
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 Nuclide Summary  
 -----

Nuclide	Activity $\mu$ Ci	Error %
CO-60		
CS-137		
CD-109		
	0.000	0.00

~~2000~~  
~~+ 81~~  
 2000 Gross wt g  
 - 193 tare (g)  
 -----  
 1807 Net wt (g)

< .11  $\mu$ Ci/g

**SAMPLES ANALYZED BY BARRINGER LABORATORIES**



9-Feb-98

Ms. Cindy Arnold  
 KEMRON  
 109 Starlite Park  
 Marietta, Ohio 45750

Attn: Project: Foster Wheeler PO #: Received: 6-Feb-98 10:10  
 Job: 981315E Status: Preliminary

We received 56 Soil samples on 6-Feb-98. This job has been logged as 981315. Please refer to this number when making inquiries.

Our current estimated completion date is 20-Feb-98. Once the QA is verified, the results can be faxed. The hard copy should be mailed within 24 hours of the above date.

Non-aqueous samples will be returned 30 days after the final report is mailed, unless otherwise specified by contract. If you have any questions, please call toll free 1-800-654-0506 or 303-277-1687.

Client Service Representative  
 Kathy Smith



9-Feb-98

Ms. Cindy Arnold  
 KEMRON  
 109 Starlite Park  
 Marietta, Ohio 45750

Attn: Project: Foster Wheeler

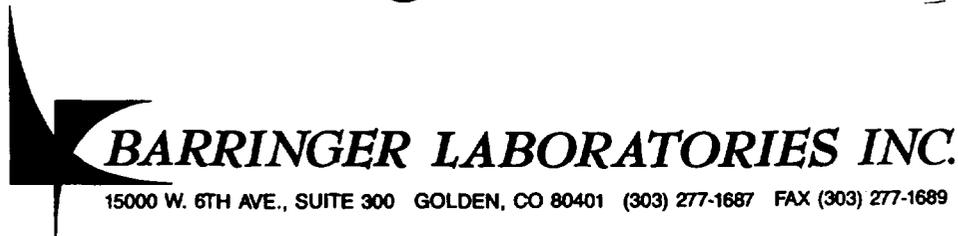
PO #:

Received: 6-Feb-98 10:10

Job: 981315E

Status: Preliminary

Lab-ID	Matrix	Client Sample ID	Sampled
981315-1	Soil	12-PVSS-X01	27-Jan-98
981315-2	Soil	12-PVSS-X02	27-Jan-98
981315-3	Soil	12-PVSS-X03	27-Jan-98
981315-4	Soil	12-PVSS-X04	27-Jan-98
981315-5	Soil	12-PVSS-X05	27-Jan-98
981315-6	Soil	12-PVSS-X06	27-Jan-98
981315-7	Soil	12-PVSS-X07	27-Jan-98
981315-8	Soil	12-PVSS-X08	27-Jan-98
981315-9	Soil	12-PVSS-X09	27-Jan-98
981315-10	Soil	12-PVSS-X10	27-Jan-98
981315-11	Soil	12-PVSS-X11	27-Jan-98
981315-12	Soil	12-PVSS-X12	27-Jan-98
981315-13	Soil	12-PVSS-X13	27-Jan-98
981315-14	Soil	12-PVSS-X14	27-Jan-98
981315-15	Soil	12-PVSS-X15	27-Jan-98
981315-16	Soil	12-PVSS-X16	27-Jan-98
981315-17	Soil	12-PVSS-X17	27-Jan-98
981315-18	Soil	12-PVSS-X18	27-Jan-98
981315-19	Soil	12-PVSS-M01	27-Jan-98
981315-20	Soil	12-PVSS-M02	27-Jan-98
981315-21	Soil	12-PVSS-M03	27-Jan-98
981315-22	Soil	12-PVSS-M04	27-Jan-98
981315-23	Soil	12-PVSS-M05	27-Jan-98
981315-24	Soil	12-PVSS-M06	27-Jan-98
981315-25	Soil	12-PVSS-M07	27-Jan-98
981315-26	Soil	12-PVSS-U01	28-Jan-98
981315-27	Soil	12-PVSS-U02	28-Jan-98
981315-28	Soil	12-PVSS-U03	28-Jan-98
981315-29	Soil	12-PVSS-U04	28-Jan-98
981315-30	Soil	12-PVSS-U05	28-Jan-98



9-Feb-98

Ms. Cindy Arnold  
 KEMRON  
 109 Starlite Park  
 Marietta, Ohio 45750

Attn:  
 Project: Foster Wheeler

PO #:

Received: 6-Feb-98 10:10

Job: 981315E

Status: Preliminary

Lab-ID	Matrix	Client Sample ID	Sampled
981315-31	Soil	12-PVSS-U06	28-Jan-98
981315-32	Soil	12-PVSS-U07	28-Jan-98
981315-33	Soil	12-PVSS-U08	28-Jan-98
981315-34	Soil	12-PVSS-U09	28-Jan-98
981315-35	Soil	12-PVSS-U10	28-Jan-98
981315-36	Soil	12-PVSS-U11	28-Jan-98
981315-37	Soil	12-PVSS-U12	28-Jan-98
981315-38	Soil	12-PVSS-U13	28-Jan-98
981315-39	Soil	12-PVSS-S01	29-Jan-98
981315-40	Soil	12-PVSS-S02	29-Jan-98
981315-41	Soil	12-PVSS-S03	29-Jan-98
981315-42	Soil	12-PVSS-S04	29-Jan-98
981315-43	Soil	12-PVSS-S05	29-Jan-98
981315-44	Soil	12-PVSS-S06	29-Jan-98
981315-45	Soil	12-PVSS-S07	29-Jan-98
981315-46	Soil	12-PVSS-S08	29-Jan-98
981315-47	Soil	12-PVSS-S09	29-Jan-98
981315-48	Soil	12-PVSS-S10	29-Jan-98
981315-49	Soil	12-PVSS-S11	29-Jan-98
981315-50	Soil	12-PVSS-S12	29-Jan-98
981315-51	Soil	12-PVSS-S13	29-Jan-98
981315-52	Soil	12-BF-28-21/01	3-Feb-98
981315-53	Soil	12-BF-27-25/01	3-Feb-98
981315-54	Soil	12-BF-29-104/01	3-Feb-98
981315-55	Soil	12-WS-54-IS26116ML	26-Jan-98
981315-56	Soil	12-WS-55-IS26150UL	15-Jan-98



**BARRINGER LABORATORIES, INC.**

15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

**I N V O I C E**

Ms. Cindy Arnold  
KEMRON  
109 Starlite Park  
Marietta, Ohio 45750

Date : 27-Feb-98

Job : 981315E

Invoice: 68295E

PO # :

Project: Foster Wheeler

Terms: Net 30 days

Sample Type: Soil

Analyses:

56 Solids:

56 Gamma Spec:GS

108.00 \$6048.00

TOTAL DUE: \$6048.00

Remit to: Barringer Laboratories, Inc.  
Dept #74  
Denver, CO 80256-0074

--- Original ---



# BARRINGER LABORATORIES, INC.

15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

## I N V O I C E

Ms. Cindy Arnold  
KEMRON  
109 Starlite Park  
Marietta, Ohio 45750

Date : 27-Feb-98

Job : 981315E

Invoice: 68295E

PO # :

Project: Foster Wheeler Terms: Net 30 days

---

Sample Type: Soil

Analyses:

56 Solids:

56 Gamma Spec:GS

108.00 \$6048.00

TOTAL DUE: \$6048.00

Remit to: Barringer Laboratories, Inc.  
Dept #74  
Denver, CO 80256-0074

--- Remittance Copy ---



**BARRINGER LABORATORIES, INC.**

15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

26-Feb-98

Ms. Cindy Arnold  
KEMRON  
109 Starlite Park  
Marietta, Ohio 45750

Attn:  
Project: Foster Wheeler

PO #:

Received: 6-Feb-98 10:10

Job: 981315E

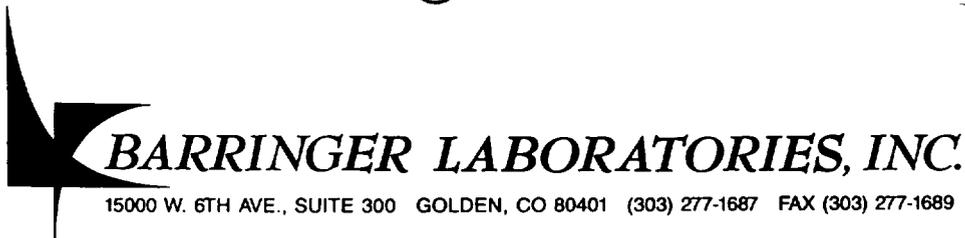
Status: Final

**ANALYTICAL REPORT PACKAGE**

CASE NARRATIVE.....i

ANALYTICAL RESULTS.....R-1

QUALITY CONTROL REPORT.....Q-1



26-Feb-98  
Page: i

Ms. Cindy Arnold  
KEMRON  
109 Starlite Park  
Marietta, Ohio 45750

Attn:  
Project: Foster Wheeler

Received: 6-Feb-98 10:10  
PO #:

Job: 981315E Status: Final

CASE NARRATIVE

A total of 56 Soil samples were received on 6-Feb-98. As stated in the chain of custody, the samples were run for the following analyses: Solids and Gamma Spectroscopy. A table, to cross reference your sample ID to ours, is attached. Our procedures are summarized on the Quality Control Data Sheet.

Quality control standards for organic and inorganic analyses followed the appropriate SW-846 or EPA methodology. Quality control standards for radiochemistry followed our standard operating procedures or contractual requirements.

Signed: *[Signature]* 4/24/98 ..... *[Signature]* .....  
Inorganic Manager Radiochemical Manager

Signed: *[Signature]*  
Project Review 2/26/98



26-Feb-98

Ms. Cindy Arnold  
 KEMRON  
 109 Starlite Park  
 Marietta, Ohio 45750

Page: ii

Attn:  
 Project: Foster Wheeler

Received: 6-Feb-98 10:10  
 PO #:

Job: 981315E Status: Final

Lab-ID	Matrix	Client Sample ID	Sampled
981315-1	Soil	12-PVSS-X01	27-Jan-98
981315-2	Soil	12-PVSS-X02	27-Jan-98
981315-3	Soil	12-PVSS-X03	27-Jan-98
981315-4	Soil	12-PVSS-X04	27-Jan-98
981315-5	Soil	12-PVSS-X05	27-Jan-98
981315-6	Soil	12-PVSS-X06	27-Jan-98
981315-7	Soil	12-PVSS-X07	27-Jan-98
981315-8	Soil	12-PVSS-X08	27-Jan-98
981315-9	Soil	12-PVSS-X09	27-Jan-98
981315-10	Soil	12-PVSS-X10	27-Jan-98
981315-11	Soil	12-PVSS-X11	27-Jan-98
981315-12	Soil	12-PVSS-X12	27-Jan-98
981315-13	Soil	12-PVSS-X13	27-Jan-98
981315-14	Soil	12-PVSS-X14	27-Jan-98
981315-15	Soil	12-PVSS-X15	27-Jan-98
981315-16	Soil	12-PVSS-X16	27-Jan-98
981315-17	Soil	12-PVSS-X17	27-Jan-98
981315-18	Soil	12-PVSS-X18	27-Jan-98
981315-19	Soil	12-PVSS-M01	27-Jan-98
981315-20	Soil	12-PVSS-M02	27-Jan-98
981315-21	Soil	12-PVSS-M03	27-Jan-98
981315-22	Soil	12-PVSS-M04	27-Jan-98
981315-23	Soil	12-PVSS-M05	27-Jan-98
981315-24	Soil	12-PVSS-M06	27-Jan-98
981315-25	Soil	12-PVSS-M07	27-Jan-98
981315-26	Soil	12-PVSS-U01	28-Jan-98
981315-27	Soil	12-PVSS-U02	28-Jan-98
981315-28	Soil	12-PVSS-U03	28-Jan-98
981315-29	Soil	12-PVSS-U04	28-Jan-98
981315-30	Soil	12-PVSS-U05	28-Jan-98



Ms. Cindy Arnold  
 KEMRON  
 109 Starlite Park  
 Marietta, Ohio 45750

26-Feb-98  
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Attn:  
 Project: Foster Wheeler

PO #:

Received: 6-Feb-98 10:10

Job: 981315E

Status: Final

Lab-ID	Matrix	Client Sample ID	Sampled
981315-31	Soil	12-PVSS-U06	28-Jan-98
981315-32	Soil	12-PVSS-U07	28-Jan-98
981315-33	Soil	12-PVSS-U08	28-Jan-98
981315-34	Soil	12-PVSS-U09	28-Jan-98
981315-35	Soil	12-PVSS-U10	28-Jan-98
981315-36	Soil	12-PVSS-U11	28-Jan-98
981315-37	Soil	12-PVSS-U12	28-Jan-98
981315-38	Soil	12-PVSS-U13	28-Jan-98
981315-39	Soil	12-PVSS-S01	29-Jan-98
981315-40	Soil	12-PVSS-S02	29-Jan-98
981315-41	Soil	12-PVSS-S03	29-Jan-98
981315-42	Soil	12-PVSS-S04	29-Jan-98
981315-43	Soil	12-PVSS-S05	29-Jan-98
981315-44	Soil	12-PVSS-S06	29-Jan-98
981315-45	Soil	12-PVSS-S07	29-Jan-98
981315-46	Soil	12-PVSS-S08	29-Jan-98
981315-47	Soil	12-PVSS-S09	29-Jan-98
981315-48	Soil	12-PVSS-S10	29-Jan-98
981315-49	Soil	12-PVSS-S11	29-Jan-98
981315-50	Soil	12-PVSS-S12	29-Jan-98
981315-51	Soil	12-PVSS-S13	29-Jan-98
981315-52	Soil	12-BF-28-21/01	3-Feb-98
981315-53	Soil	12-BF-27-25/01	3-Feb-98
981315-54	Soil	12-BF-29-104/01	3-Feb-98
981315-55	Soil	12-WS-54-IS26116ML	26-Jan-98
981315-56	Soil	12-WS-55-IS26150ML	15-Jan-98



# BARRINGER LABORATORIES, INC.

15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

26-Feb-98

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Job: 981315E

Status: Final

## KEMRON

Analyte: Solids

Project: Foster Wheeler

Fraction:

Date Analyzed: 02/12-02/15

Method: CLP SOW

Units: %

Lab Id	Date Sampled	Matrix	Sample Id	Concentration	MDL
981315-1	27-Jan-98	Soil	12-PVSS-X01	82.4	0.1
981315-2	27-Jan-98	Soil	12-PVSS-X02	87.5	0.1
981315-3	27-Jan-98	Soil	12-PVSS-X03	85.2	0.1
981315-4	27-Jan-98	Soil	12-PVSS-X04	87.9	0.1
981315-5	27-Jan-98	Soil	12-PVSS-X05	92.2	0.1
981315-6	27-Jan-98	Soil	12-PVSS-X06	86.9	0.1
981315-7	27-Jan-98	Soil	12-PVSS-X07	78.9	0.1
981315-8	27-Jan-98	Soil	12-PVSS-X08	85.3	0.1
981315-9	27-Jan-98	Soil	12-PVSS-X09	88.6	0.1
981315-10	27-Jan-98	Soil	12-PVSS-X10	91.8	0.1
981315-11	27-Jan-98	Soil	12-PVSS-X11	84.8	0.1
981315-12	27-Jan-98	Soil	12-PVSS-X12	89.1	0.1
981315-13	27-Jan-98	Soil	12-PVSS-X13	81.5	0.1
981315-14	27-Jan-98	Soil	12-PVSS-X14	82.6	0.1
981315-15	27-Jan-98	Soil	12-PVSS-X15	80.3	0.1
981315-16	27-Jan-98	Soil	12-PVSS-X16	79.0	0.1
981315-17	27-Jan-98	Soil	12-PVSS-X17	83.5	0.1
981315-18	27-Jan-98	Soil	12-PVSS-X18	86.5	0.1
981315-19	27-Jan-98	Soil	12-PVSS-M01	61.3	0.1
981315-20	27-Jan-98	Soil	12-PVSS-M02	63.9	0.1
981315-21	27-Jan-98	Soil	12-PVSS-M03	70.2	0.1
981315-22	27-Jan-98	Soil	12-PVSS-M04	38.0	0.1
981315-23	27-Jan-98	Soil	12-PVSS-M05	70.9	0.1
981315-24	27-Jan-98	Soil	12-PVSS-M06	80.9	0.1
981315-25	27-Jan-98	Soil	12-PVSS-M07	64.1	0.1
981315-26	28-Jan-98	Soil	12-PVSS-U01	69.9	0.1
981315-27	28-Jan-98	Soil	12-PVSS-U02	75.8	0.1
981315-28	28-Jan-98	Soil	12-PVSS-U03	79.9	0.1
981315-29	28-Jan-98	Soil	12-PVSS-U04	87.5	0.1
981315-30	28-Jan-98	Soil	12-PVSS-U05	76.7	0.1
981315-31	28-Jan-98	Soil	12-PVSS-U06	78.0	0.1
981315-32	28-Jan-98	Soil	12-PVSS-U07	72.5	0.1
981315-33	28-Jan-98	Soil	12-PVSS-U08	70.1	0.1
981315-34	28-Jan-98	Soil	12-PVSS-U09	72.4	0.1
981315-35	28-Jan-98	Soil	12-PVSS-U10	70.7	0.1
981315-36	28-Jan-98	Soil	12-PVSS-U11	70.9	0.1
981315-37	28-Jan-98	Soil	12-PVSS-U12	72.7	0.1
981315-38	28-Jan-98	Soil	12-PVSS-U13	77.5	0.1
981315-39	29-Jan-98	Soil	12-PVSS-S01	82.8	0.1
981315-40	29-Jan-98	Soil	12-PVSS-S02	88.1	0.1
981315-41	29-Jan-98	Soil	12-PVSS-S03	83.6	0.1
981315-42	29-Jan-98	Soil	12-PVSS-S04	84.4	0.1
981315-43	29-Jan-98	Soil	12-PVSS-S05	83.3	0.1



# BARRINGER LABORATORIES, INC.

15000 W. 6TH AVE., SUITE 300 GOLDEN, CO 80401 (303) 277-1687 FAX (303) 277-1689

26-Feb-98

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Job: 981315E

Status: Final

## KEMRON

Analyte: Solids

Fraction:

Method: CLP SOW

Project: Foster Wheeler

Date Analyzed: 02/12-02/15

Units: %

Lab Id	Date Sampled	Matrix	Sample Id	Concentration	MDL
981315-44	29-Jan-98	Soil	12-PVSS-S06	88.3	0.1
981315-45	29-Jan-98	Soil	12-PVSS-S07	90.5	0.1
981315-46	29-Jan-98	Soil	12-PVSS-S08	88.9	0.1
981315-47	29-Jan-98	Soil	12-PVSS-S09	86.9	0.1
981315-48	29-Jan-98	Soil	12-PVSS-S10	80.3	0.1
981315-49	29-Jan-98	Soil	12-PVSS-S11	77.3	0.1
981315-50	29-Jan-98	Soil	12-PVSS-S12	81.4	0.1
981315-51	29-Jan-98	Soil	12-PVSS-S13	87.1	0.1
981315-52	3-Feb-98	Soil	12-BF-28-21/01	87.9	0.1
981315-53	3-Feb-98	Soil	12-BF-27-25/01	89.8	0.1
981315-54	3-Feb-98	Soil	12-BF-29-104/01	89.3	0.1
981315-55	26-Jan-98	Soil	12-WS-54-IS26116ML	85.0	0.1
981315-56	15-Jan-98	Soil	12-WS-55-IS26150ML	90.8	0.1

**KEMRON**

**Gamma Spectroscopy**

**Sample Id: 12-PVSS-X01**  
**Lab Id: 981315-1**  
**Date Sampled: 27-Jan-98**

**Project: Foster Wheeler**  
**Matrix: Soil**

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Bi-212*	GS	U	pCi/g	1.0	02/12-02/24
Bi-214*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	1.3±0.1	pCi/g	0.1	02/12-02/24
K-40*	GS	6.1±1.1	pCi/g	1.0	02/12-02/24
Pb-210*	GS	U	pCi/g	1.9	02/12-02/24
Pb-212*	GS	0.7±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.2	02/12-02/24
Tl-208*	GS	0.32±0.07	pCi/g	0.07	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24

**Sample Id: 12-PVSS-X02**  
**Lab Id: 981315-2**  
**Date Sampled: 27-Jan-98**

**Project: Foster Wheeler**  
**Matrix: Soil**

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.8±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.2	02/12-02/24
Bi-214*	GS	0.5±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	4.6±0.3	pCi/g	0.1	02/12-02/24
K-40*	GS	5.3±1.1	pCi/g	1.0	02/12-02/24
Pb-210*	GS	U	pCi/g	2.4	02/12-02/24
Pb-212*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.7±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.5±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.4	02/12-02/24
Tl-208*	GS	0.24±0.08	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

**KEMRON**

**Gamma Spectroscopy**

Sample Id: 12-PVSS-X03  
 Lab Id: 981315-3  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.6±0.2	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.1	02/12-02/24
Bi-214*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	7.0±0.4	pCi/g	0.1	02/12-02/24
K-40*	GS	4.9±1.0	pCi/g	1.0	02/12-02/24
Pb-210*	GS	U	pCi/g	2.3	02/12-02/24
Pb-212*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.6±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.6	02/12-02/24
Tl-208*	GS	0.27±0.08	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

Sample Id: 12-PVSS-X04  
 Lab Id: 981315-4  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.8±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.0	02/12-02/24
Bi-214*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	6.4±0.4	pCi/g	0.2	02/12-02/24
K-40*	GS	5.0±1.1	pCi/g	1.1	02/12-02/24
Pb-210*	GS	U	pCi/g	2.4	02/12-02/24
Pb-212*	GS	0.8±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.5±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.4	02/12-02/24
Tl-208*	GS	0.22±0.07	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

KEMRON

Gamma Spectroscopy

Sample Id: 12-PVSS-X05  
 Lab Id: 981315-5  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.7±0.2	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.0	02/12-02/24
Bi-214*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	1.8±0.2	pCi/g	0.1	02/12-02/24
K-40*	GS	3.8±1.0	pCi/g	1.2	02/12-02/24
Pb-210*	GS	U	pCi/g	1.9	02/12-02/24
Pb-212*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.5±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.1	02/12-02/24
Tl-208*	GS	0.19±0.06	pCi/g	0.09	02/12-02/24
U-235*	GS	U	pCi/g	0.5	02/12-02/24

Sample Id: 12-PVSS-X06  
 Lab Id: 981315-6  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.8±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.1	02/12-02/24
Bi-214*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	4.0±0.3	pCi/g	0.1	02/12-02/24
K-40*	GS	5.3±1.2	pCi/g	1.4	02/12-02/24
Pb-210*	GS	U	pCi/g	2.5	02/12-02/24
Pb-212*	GS	0.8±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.5±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.4	02/12-02/24
Tl-208*	GS	0.24±0.07	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24

**KEMRON**

**Gamma Spectroscopy**

Sample Id: 12-PVSS-X07  
 Lab Id: 981315-7  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ	LLD	Date Analyzed
Ac-228*	GS	0.8±0.3 pCi/g	0.4	02/12-02/24
Bi-212*	GS	U pCi/g	1.7	02/12-02/24
Bi-214*	GS	0.7±0.2 pCi/g	0.3	02/12-02/24
Co-57*	GS	U pCi/g	0.1	02/12-02/24
Co-60*	GS	U pCi/g	0.1	02/12-02/24
Cs-134*	GS	U pCi/g	0.1	02/12-02/24
Cs-137*	GS	6.2±0.4 pCi/g	0.1	02/12-02/24
K-40*	GS	4.6±1.3 pCi/g	1.6	02/12-02/24
Pb-210*	GS	U pCi/g	2.9	02/12-02/24
Pb-212*	GS	0.6±0.2 pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.6±0.2 pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.7±0.2 pCi/g	0.3	02/12-02/24
Th-234*	GS	U pCi/g	1.7	02/12-02/24
Tl-208*	GS	0.20±0.09 pCi/g	0.1	02/12-02/24
U-235*	GS	U pCi/g	0.8	02/12-02/24

Sample Id: 12-PVSS-X08  
 Lab Id: 981315-8  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ	LLD	Date Analyzed
Ac-228*	GS	0.7±0.3 pCi/g	0.3	02/12-02/24
Bi-212*	GS	U pCi/g	1.4	02/12-02/24
Bi-214*	GS	0.6±0.1 pCi/g	0.2	02/12-02/24
Co-57*	GS	U pCi/g	0.1	02/12-02/24
Co-60*	GS	U pCi/g	0.1	02/12-02/24
Cs-134*	GS	U pCi/g	0.1	02/12-02/24
Cs-137*	GS	4.8±0.3 pCi/g	0.1	02/12-02/24
K-40*	GS	5.8±1.1 pCi/g	0.8	02/12-02/24
Pb-210*	GS	U pCi/g	2.3	02/12-02/24
Pb-212*	GS	0.8±0.1 pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.7±0.2 pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.6±0.1 pCi/g	0.2	02/12-02/24
Th-234*	GS	U pCi/g	1.4	02/12-02/24
Tl-208*	GS	0.28±0.08 pCi/g	0.1	02/12-02/24
U-235*	GS	U pCi/g	0.7	02/12-02/24

KEMRON

Gamma Spectroscopy

Sample Id: 12-PVSS-X09  
 Lab Id: 981315-9  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.6±0.2	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.0	02/12-02/24
Bi-214*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	6.7±0.3	pCi/g	0.1	02/12-02/24
K-40*	GS	4.3±0.9	pCi/g	1.2	02/12-02/24
Pb-210*	GS	U	pCi/g	2.1	02/12-02/24
Pb-212*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.3	02/12-02/24
Tl-208*	GS	0.19±0.06	pCi/g	0.08	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

Sample Id: 12-PVSS-X10  
 Lab Id: 981315-10  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.8±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.2	02/12-02/24
Bi-214*	GS	0.5±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	4.4±0.3	pCi/g	0.1	02/12-02/24
K-40*	GS	5.1±1.2	pCi/g	1.4	02/12-02/24
Pb-210*	GS	U	pCi/g	2.7	02/12-02/24
Pb-212*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.5±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.5±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.4	02/12-02/24
Tl-208*	GS	0.19±0.07	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.8	02/12-02/24

KEMRON

Gamma Spectroscopy

Sample Id: 12-PVSS-X11  
 Lab Id: 981315-11  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.8±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.5	02/12-02/24
Bi-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	3.0±0.2	pCi/g	0.1	02/12-02/24
K-40*	GS	8.1±1.3	pCi/g	0.9	02/12-02/24
Pb-210*	GS	U	pCi/g	2.1	02/12-02/24
Pb-212*	GS	0.7±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.3	02/12-02/24
Tl-208*	GS	0.35±0.09	pCi/g	0.09	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24

Sample Id: 12-PVSS-X12  
 Lab Id: 981315-12  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.7±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.1	02/12-02/24
Bi-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	4.2±0.3	pCi/g	0.1	02/12-02/24
K-40*	GS	5.5±1.1	pCi/g	1.2	02/12-02/24
Pb-210*	GS	U	pCi/g	2.4	02/12-02/24
Pb-212*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.4	02/12-02/24
Tl-208*	GS	0.26±0.07	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24

**KEMRON**

**Gamma Spectroscopy**

Sample Id: 12-PVSS-X13  
 Lab Id: 981315-13  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ	LLD	Date Analyzed
Ac-228*	GS	1.1±0.3 pCi/g	0.4	02/12-02/24
Bi-212*	GS	U pCi/g	1.4	02/12-02/24
Bi-214*	GS	0.8±0.2 pCi/g	0.2	02/12-02/24
Co-57*	GS	U pCi/g	0.1	02/12-02/24
Co-60*	GS	U pCi/g	0.1	02/12-02/24
Cs-134*	GS	U pCi/g	0.1	02/12-02/24
Cs-137*	GS	1.3±0.2 pCi/g	0.1	02/12-02/24
K-40*	GS	10±2 pCi/g	1.5	02/12-02/24
Pb-210*	GS	U pCi/g	2.3	02/12-02/24
Pb-212*	GS	1.0±0.2 pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.9±0.2 pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.8±0.2 pCi/g	0.2	02/12-02/24
Th-234*	GS	U pCi/g	1.4	02/12-02/24
Tl-208*	GS	0.40±0.08 pCi/g	0.1	02/12-02/24
U-235*	GS	U pCi/g	0.7	02/12-02/24

Sample Id: 12-PVSS-X14  
 Lab Id: 981315-14  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ	LLD	Date Analyzed
Ac-228*	GS	1.1±0.4 pCi/g	0.4	02/12-02/24
Bi-212*	GS	U pCi/g	1.3	02/12-02/24
Bi-214*	GS	0.7±0.2 pCi/g	0.2	02/12-02/24
Co-57*	GS	U pCi/g	0.1	02/12-02/24
Co-60*	GS	U pCi/g	0.1	02/12-02/24
Cs-134*	GS	U pCi/g	0.1	02/12-02/24
Cs-137*	GS	0.3±0.1 pCi/g	0.1	02/12-02/24
K-40*	GS	7.7±1.4 pCi/g	1.4	02/12-02/24
Pb-210*	GS	U pCi/g	2.3	02/12-02/24
Pb-212*	GS	1.1±0.1 pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.8±0.2 pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.7±0.2 pCi/g	0.2	02/12-02/24
Th-234*	GS	U pCi/g	1.5	02/12-02/24
Tl-208*	GS	0.41±0.09 pCi/g	0.1	02/12-02/24
U-235*	GS	U pCi/g	0.7	02/12-02/24



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26-Feb-98

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Job: 981315E

Status: Final

## KEMRON

### Gamma Spectroscopy

Sample Id: 12-PVSS-X15  
Lab Id: 981315-15  
Date Sampled: 27-Jan-98

Project: Foster Wheeler  
Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.9±0.3	pCi/g	0.4	02/12-02/24
Bi-212*	GS	U	pCi/g	1.1	02/12-02/24
Bi-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	2.4±0.2	pCi/g	0.1	02/12-02/24
K-40*	GS	6.7±1.4	pCi/g	1.5	02/12-02/24
Pb-210*	GS	U	pCi/g	2.4	02/12-02/24
Pb-212*	GS	1.0±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.7	02/12-02/24
Tl-208*	GS	0.33±0.08	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

Sample Id: 12-PVSS-X16  
Lab Id: 981315-16  
Date Sampled: 27-Jan-98

Project: Foster Wheeler  
Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	1.2±0.4	pCi/g	0.4	02/12-02/24
Bi-212*	GS	U	pCi/g	1.4	02/12-02/24
Bi-214*	GS	1.0±0.2	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	3.6±0.3	pCi/g	0.2	02/12-02/24
K-40*	GS	7.9±1.6	pCi/g	1.8	02/12-02/24
Pb-210*	GS	U	pCi/g	3.0	02/12-02/24
Pb-212*	GS	1.2±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.9±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	1.0±0.2	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	1.7	02/12-02/24
Tl-208*	GS	0.32±0.09	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.8	02/12-02/24

**KEMRON**

**Gamma Spectroscopy**

Sample Id: 12-PVSS-X17  
 Lab Id: 981315-17  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.9±0.3	pCi/g	0.4	02/12-02/24
Bi-212*	GS	1.4±0.7	pCi/g	1.1	02/12-02/24
Bi-214*	GS	0.9±0.2	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	9.8±0.5	pCi/g	0.2	02/12-02/24
K-40*	GS	6.9±1.4	pCi/g	1.4	02/12-02/24
Pb-210*	GS	U	pCi/g	3.2	02/12-02/24
Pb-212*	GS	0.9±0.2	pCi/g	0.3	02/12-02/24
Pb-214*	GS	1.0±0.3	pCi/g	0.4	02/12-02/24
Ra-226*	GS	0.9±0.2	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	2.0	02/12-02/24
Tl-208*	GS	0.35±0.09	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	1.0	02/12-02/24

Sample Id: 12-PVSS-X18  
 Lab Id: 981315-18  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.6±0.2	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.2	02/12-02/24
Bi-214*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	3.8±0.3	pCi/g	0.1	02/12-02/24
K-40*	GS	4.9±1.1	pCi/g	1.3	02/12-02/24
Pb-210*	GS	U	pCi/g	2.5	02/12-02/24
Pb-212*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.7	02/12-02/24
Tl-208*	GS	0.28±0.07	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

**KEMRON**

**Gamma Spectroscopy**

**Sample Id: 12-PVSS-M01**  
**Lab Id: 981315-19**  
**Date Sampled: 27-Jan-98**

**Project: Foster Wheeler**  
**Matrix: Soil**

Analyte	Fraction	Conc. + 2σ	LLD	Date Analyzed
Ac-228*	GS	0.9±0.4 pCi/g	0.5	02/12-02/24
Bi-212*	GS	U pCi/g	1.3	02/12-02/24
Bi-214*	GS	0.8±0.2 pCi/g	0.3	02/12-02/24
Co-57*	GS	U pCi/g	0.1	02/12-02/24
Co-60*	GS	U pCi/g	0.1	02/12-02/24
Cs-134*	GS	U pCi/g	0.1	02/12-02/24
Cs-137*	GS	U pCi/g	0.2	02/12-02/24
K-40*	GS	4.7±1.2 pCi/g	1.2	02/12-02/24
Pb-210*	GS	U pCi/g	2.9	02/12-02/24
Pb-212*	GS	0.9±0.2 pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.8±0.3 pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.8±0.2 pCi/g	0.3	02/12-02/24
Th-234*	GS	U pCi/g	1.7	02/12-02/24
Tl-208*	GS	0.26±0.08 pCi/g	0.1	02/12-02/24
U-235*	GS	U pCi/g	0.8	02/12-02/24

**Sample Id: 12-PVSS-M02**  
**Lab Id: 981315-20**  
**Date Sampled: 27-Jan-98**

**Project: Foster Wheeler**  
**Matrix: Soil**

Analyte	Fraction	Conc. + 2σ	LLD	Date Analyzed
Ac-228*	GS	1.3±0.5 pCi/g	0.7	02/12-02/24
Bi-212*	GS	U pCi/g	1.7	02/12-02/24
Bi-214*	GS	0.9±0.2 pCi/g	0.3	02/12-02/24
Co-57*	GS	U pCi/g	0.1	02/12-02/24
Co-60*	GS	U pCi/g	0.2	02/12-02/24
Cs-134*	GS	U pCi/g	0.1	02/12-02/24
Cs-137*	GS	U pCi/g	0.2	02/12-02/24
K-40*	GS	9.5±2.1 pCi/g	2.6	02/12-02/24
Pb-210*	GS	4.3±2.2 pCi/g	3.9	02/12-02/24
Pb-212*	GS	1.4±0.2 pCi/g	0.3	02/12-02/24
Pb-214*	GS	1.0±0.3 pCi/g	0.4	02/12-02/24
Ra-226*	GS	0.9±0.2 pCi/g	0.3	02/12-02/24
Th-234*	GS	U pCi/g	2.2	02/12-02/24
Tl-208*	GS	0.5±0.1 pCi/g	0.1	02/12-02/24
U-235*	GS	U pCi/g	1.0	02/12-02/24

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Gamma Spectroscopy

Sample Id: 12-PVSS-M03  
 Lab Id: 981315-21  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	1.0±0.3	pCi/g	0.4	02/12-02/24
Bi-212*	GS	U	pCi/g	1.8	02/12-02/24
Bi-214*	GS	0.9±0.3	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	0.2±0.1	pCi/g	0.1	02/12-02/24
K-40*	GS	8.3±1.7	pCi/g	1.6	02/12-02/24
Pb-210*	GS	3.7±2.2	pCi/g	3.7	02/12-02/24
Pb-212*	GS	1.3±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.9±0.3	pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.9±0.3	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	1.5	02/12-02/24
Tl-208*	GS	0.4±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

Sample Id: 12-PVSS-M04  
 Lab Id: 981315-22  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	1.4±0.5	pCi/g	0.7	02/12-02/24
Bi-212*	GS	U	pCi/g	2.8	02/12-02/24
Bi-214*	GS	1.6±0.4	pCi/g	0.5	02/12-02/24
Co-57*	GS	U	pCi/g	0.2	02/12-02/24
Co-60*	GS	U	pCi/g	0.3	02/12-02/24
Cs-134*	GS	U	pCi/g	0.2	02/12-02/24
Cs-137*	GS	U	pCi/g	0.2	02/12-02/24
K-40*	GS	12±3	pCi/g	2.9	02/12-02/24
Pb-210*	GS	U	pCi/g	6.4	02/12-02/24
Pb-212*	GS	1.8±0.4	pCi/g	0.4	02/12-02/24
Pb-214*	GS	1.8±0.5	pCi/g	0.5	02/12-02/24
Ra-226*	GS	1.6±0.4	pCi/g	0.5	02/12-02/24
Th-234*	GS	U	pCi/g	2.6	02/12-02/24
Tl-208*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
U-235*	GS	U	pCi/g	1.4	02/12-02/24

**KEMRON**

**Gamma Spectroscopy**

Sample Id: 12-PVSS-M05  
 Lab Id: 981315-23  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	0.5±0.3	pCi/g	0.4	02/12-02/24
Bi-212*	GS	U	pCi/g	1.6	02/12-02/24
Bi-214*	GS	0.5±0.2	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.2	02/12-02/24
Cs-134*	GS	U	pCi/g	0.2	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	5.6±1.4	pCi/g	1.5	02/12-02/24
Pb-210*	GS	3.4±1.7	pCi/g	2.6	02/12-02/24
Pb-212*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.5±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.5±0.2	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	1.3	02/12-02/24
Tl-208*	GS	0.3±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

Sample Id: 12-PVSS-M06  
 Lab Id: 981315-24  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	U	pCi/g	0.4	02/12-02/24
Bi-212*	GS	U	pCi/g	1.1	02/12-02/24
Bi-214*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	3.4±1.0	pCi/g	1.0	02/12-02/24
Pb-210*	GS	U	pCi/g	2.0	02/12-02/24
Pb-212*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.3±0.1	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.0	02/12-02/24
Tl-208*	GS	0.19±0.06	pCi/g	0.07	02/12-02/24
U-235*	GS	U	pCi/g	0.5	02/12-02/24

**KEMRON**

**Gamma Spectroscopy**

Sample Id: 12-PVSS-M07  
 Lab Id: 981315-25  
 Date Sampled: 27-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.6±0.3	pCi/g	0.4	02/12-02/24
Bi-212*	GS	U	pCi/g	1.7	02/12-02/24
Bi-214*	GS	0.6±0.2	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.2	02/12-02/24
Cs-134*	GS	U	pCi/g	0.2	02/12-02/24
Cs-137*	GS	0.14±0.07	pCi/g	0.11	02/12-02/24
K-40*	GS	4.5±1.4	pCi/g	1.7	02/12-02/24
Pb-210*	GS	U	pCi/g	3.4	02/12-02/24
Pb-212*	GS	0.9±0.2	pCi/g	0.3	02/12-02/24
Pb-214*	GS	1.0±0.3	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.6±0.2	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	1.6	02/12-02/24
Tl-208*	GS	0.2±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

Sample Id: 12-PVSS-U01  
 Lab Id: 981315-26  
 Date Sampled: 28-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	1.3±0.4	pCi/g	0.7	02/12-02/24
Bi-212*	GS	U	pCi/g	1.4	02/12-02/24
Bi-214*	GS	1.0±0.2	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.2	02/12-02/24
K-40*	GS	16±2	pCi/g	1.5	02/12-02/24
Pb-210*	GS	U	pCi/g	2.6	02/12-02/24
Pb-212*	GS	1.3±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	1.0±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	1.0±0.2	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	1.4	02/12-02/24
Tl-208*	GS	0.3±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

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## KEMRON

### Gamma Spectroscopy

Sample Id: 12-PVSS-U02

Lab Id: 981315-27

Date Sampled: 28-Jan-98

Project: Foster Wheeler

Matrix: Soil

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	0.8±0.2	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.3	02/12-02/24
Bi-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	0.13±0.06	pCi/g	0.09	02/12-02/24
K-40*	GS	6.2±1.2	pCi/g	1.3	02/12-02/24
Pb-210*	GS	U	pCi/g	2.0	02/12-02/24
Pb-212*	GS	0.8±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.1	02/12-02/24
Tl-208*	GS	0.3±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24

Sample Id: 12-PVSS-U03

Lab Id: 981315-28

Date Sampled: 28-Jan-98

Project: Foster Wheeler

Matrix: Soil

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	0.6±0.2	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	0.9	02/12-02/24
Bi-214*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	1.1±0.1	pCi/g	0.1	02/12-02/24
K-40*	GS	4.6±1.1	pCi/g	1.1	02/12-02/24
Pb-210*	GS	U	pCi/g	2.2	02/12-02/24
Pb-212*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.1	02/12-02/24
Tl-208*	GS	0.14±0.05	pCi/g	0.08	02/12-02/24
U-235*	GS	U	pCi/g	0.5	02/12-02/24

**KEMRON**

**Gamma Spectroscopy**

Sample Id: 12-PVSS-U04  
 Lab Id: 981315-29  
 Date Sampled: 28-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.7±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.4	02/12-02/24
Bi-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	1.2±0.2	pCi/g	0.1	02/12-02/24
K-40*	GS	6.1±1.4	pCi/g	1.7	02/12-02/24
Pb-210*	GS	U	pCi/g	2.9	02/12-02/24
Pb-212*	GS	0.9±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.3	02/12-02/24
Tl-208*	GS	0.2±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

Sample Id: 12-PVSS-U05  
 Lab Id: 981315-30  
 Date Sampled: 28-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.7±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.1	02/12-02/24
Bi-214*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	4.6±1.1	pCi/g	1.1	02/12-02/24
Pb-210*	GS	U	pCi/g	2.2	02/12-02/24
Pb-212*	GS	0.7±0.1	pCi/g	0.1	02/12-02/24
Pb-214*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.3	02/12-02/24
Tl-208*	GS	0.28±0.07	pCi/g	0.09	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24



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### Gamma Spectroscopy

Sample Id: 12-PVSS-U06  
Lab Id: 981315-31  
Date Sampled: 28-Jan-98

Project: Foster Wheeler  
Matrix: Soil

Analyte	Fraction	Conc. + 2σ	LLD	Date Analyzed
Ac-228*	GS	0.8±0.3 pCi/g	0.3	02/12-02/24
Bi-212*	GS	U pCi/g	1.9	02/12-02/24
Bi-214*	GS	0.6±0.2 pCi/g	0.3	02/12-02/24
Co-57*	GS	U pCi/g	0.1	02/12-02/24
Co-60*	GS	U pCi/g	0.1	02/12-02/24
Cs-134*	GS	U pCi/g	0.2	02/12-02/24
Cs-137*	GS	1.1±0.2 pCi/g	0.1	02/12-02/24
K-40*	GS	8.2±1.7 pCi/g	1.4	02/12-02/24
Pb-210*	GS	U pCi/g	3.0	02/12-02/24
Pb-212*	GS	0.8±0.2 pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.9±0.2 pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.6±0.2 pCi/g	0.3	02/12-02/24
Th-234*	GS	U pCi/g	2.2	02/12-02/24
Tl-208*	GS	0.32±0.09 pCi/g	0.1	02/12-02/24
U-235*	GS	U pCi/g	0.9	02/12-02/24

Sample Id: 12-PVSS-U07  
Lab Id: 981315-32  
Date Sampled: 28-Jan-98

Project: Foster Wheeler  
Matrix: Soil

Analyte	Fraction	Conc. + 2σ	LLD	Date Analyzed
Ac-228*	GS	1.3±0.3 pCi/g	0.4	02/12-02/24
Bi-212*	GS	U pCi/g	1.6	02/12-02/24
Bi-214*	GS	1.1±0.3 pCi/g	0.3	02/12-02/24
Co-57*	GS	U pCi/g	0.1	02/12-02/24
Co-60*	GS	U pCi/g	0.2	02/12-02/24
Cs-134*	GS	U pCi/g	0.1	02/12-02/24
Cs-137*	GS	0.4±0.1 pCi/g	0.1	02/12-02/24
K-40*	GS	8.5±1.5 pCi/g	0.9	02/12-02/24
Pb-210*	GS	U pCi/g	2.9	02/12-02/24
Pb-212*	GS	1.0±0.2 pCi/g	0.3	02/12-02/24
Pb-214*	GS	1.0±0.2 pCi/g	0.3	02/12-02/24
Ra-226*	GS	1.1±0.3 pCi/g	0.3	02/12-02/24
Th-234*	GS	U pCi/g	1.9	02/12-02/24
Tl-208*	GS	0.31±0.09 pCi/g	0.1	02/12-02/24
U-235*	GS	U pCi/g	0.8	02/12-02/24

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**KEMRON****Gamma Spectroscopy****Sample Id: 12-PVSS-U08****Lab Id: 981315-33****Date Sampled: 28-Jan-98****Project: Foster Wheeler****Matrix: Soil**

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	0.7±0.3	pCi/g	0.4	02/12-02/24
Bi-212*	GS	U	pCi/g	1.5	02/12-02/24
Bi-214*	GS	1.1±0.2	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.2	02/12-02/24
Cs-137*	GS	1.0±0.1	pCi/g	0.1	02/12-02/24
K-40*	GS	6.8±1.5	pCi/g	1.8	02/12-02/24
Pb-210*	GS	U	pCi/g	3.0	02/12-02/24
Pb-212*	GS	1.0±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	1.0±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	1.1±0.2	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	2.1	02/12-02/24
Tl-208*	GS	0.32±0.09	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

**Sample Id: 12-PVSS-U09****Lab Id: 981315-34****Date Sampled: 28-Jan-98****Project: Foster Wheeler****Matrix: Soil**

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	0.9±0.4	pCi/g	0.5	02/12-02/24
Bi-212*	GS	U	pCi/g	2.2	02/12-02/24
Bi-214*	GS	0.9±0.3	pCi/g	0.4	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.2	02/12-02/24
Cs-134*	GS	U	pCi/g	0.2	02/12-02/24
Cs-137*	GS	1.2±0.2	pCi/g	0.2	02/12-02/24
K-40*	GS	11±2	pCi/g	1.3	02/12-02/24
Pb-210*	GS	U	pCi/g	4.2	02/12-02/24
Pb-212*	GS	1.1±0.2	pCi/g	0.3	02/12-02/24
Pb-214*	GS	1.2±0.3	pCi/g	0.4	02/12-02/24
Ra-226*	GS	0.9±0.3	pCi/g	0.4	02/12-02/24
Th-234*	GS	U	pCi/g	2.4	02/12-02/24
Tl-208*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
U-235*	GS	U	pCi/g	1.1	02/12-02/24

KEMRON

Gamma Spectroscopy

Sample Id: 12-PVSS-U10  
 Lab Id: 981315-35  
 Date Sampled: 28-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	0.8±0.3	pCi/g	0.5	02/12-02/24
Bi-212*	GS	U	pCi/g	1.4	02/12-02/24
Bi-214*	GS	0.8±0.2	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.2	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	1.7±0.2	pCi/g	0.2	02/12-02/24
K-40*	GS	5.4±1.6	pCi/g	2.2	02/12-02/24
Pb-210*	GS	U	pCi/g	3.2	02/12-02/24
Pb-212*	GS	0.6±0.2	pCi/g	0.3	02/12-02/24
Pb-214*	GS	0.7±0.3	pCi/g	0.4	02/12-02/24
Ra-226*	GS	0.8±0.2	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	2.1	02/12-02/24
Tl-208*	GS	0.21±0.09	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.9	02/12-02/24

Sample Id: 12-PVSS-U11  
 Lab Id: 981315-36  
 Date Sampled: 28-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	0.8±0.4	pCi/g	0.7	02/12-02/24
Bi-212*	GS	U	pCi/g	1.8	02/12-02/24
Bi-214*	GS	1.0±0.2	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.2	02/12-02/24
Cs-134*	GS	U	pCi/g	0.2	02/12-02/24
Cs-137*	GS	0.9±0.2	pCi/g	0.2	02/12-02/24
K-40*	GS	5.1±1.7	pCi/g	2.4	02/12-02/24
Pb-210*	GS	U	pCi/g	3.6	02/12-02/24
Pb-212*	GS	0.8±0.2	pCi/g	0.3	02/12-02/24
Pb-214*	GS	0.8±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	1.0±0.2	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	2.3	02/12-02/24
Tl-208*	GS	0.3±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	1.0	02/12-02/24



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## Gamma Spectroscopy

Sample Id: 12-PVSS-U12  
Lab Id: 981315-37  
Date Sampled: 28-Jan-98

Project: Foster Wheeler  
Matrix: Soil

Analyte	Fraction	Conc. + 2σ	LLD	Date Analyzed
Ac-228*	GS	0.8±0.2	pCi/g	0.2 02/12-02/24
Bi-212*	GS	0.9 0.5	pCi/g	0.9 02/12-02/24
Bi-214*	GS	0.5±0.1	pCi/g	0.1 02/12-02/24
Co-57*	GS	U	pCi/g	0.1 02/12-02/24
Co-60*	GS	U	pCi/g	0.1 02/12-02/24
Cs-134*	GS	U	pCi/g	0.1 02/12-02/24
Cs-137*	GS	0.3±0.1	pCi/g	0.1 02/12-02/24
K-40*	GS	3.5±0.8	pCi/g	0.7 02/12-02/24
Pb-210*	GS	U	pCi/g	1.9 02/12-02/24
Pb-212*	GS	0.5±0.1	pCi/g	0.1 02/12-02/24
Pb-214*	GS	0.7±0.2	pCi/g	0.2 02/12-02/24
Ra-226*	GS	0.5±0.1	pCi/g	0.1 02/12-02/24
Th-234*	GS	U	pCi/g	1.3 02/12-02/24
Tl-208*	GS	0.19±0.06	pCi/g	0.08 02/12-02/24
U-235*	GS	U	pCi/g	0.6 02/12-02/24

Sample Id: 12-PVSS-U13  
Lab Id: 981315-38  
Date Sampled: 28-Jan-98

Project: Foster Wheeler  
Matrix: Soil

Analyte	Fraction	Conc. + 2σ	LLD	Date Analyzed
Ac-228*	GS	0.9±0.3	pCi/g	0.5 02/12-02/24
Bi-212*	GS	U	pCi/g	1.7 02/12-02/24
Bi-214*	GS	0.7±0.2	pCi/g	0.3 02/12-02/24
Co-57*	GS	U	pCi/g	0.1 02/12-02/24
Co-60*	GS	U	pCi/g	0.2 02/12-02/24
Cs-134*	GS	U	pCi/g	0.1 02/12-02/24
Cs-137*	GS	1.3±0.2	pCi/g	0.2 02/12-02/24
K-40*	GS	7.2±1.6	pCi/g	1.6 02/12-02/24
Pb-210*	GS	U	pCi/g	3.1 02/12-02/24
Pb-212*	GS	0.8±0.2	pCi/g	0.2 02/12-02/24
Pb-214*	GS	0.6±0.2	pCi/g	0.3 02/12-02/24
Ra-226*	GS	0.7±0.2	pCi/g	0.3 02/12-02/24
Th-234*	GS	U	pCi/g	1.9 02/12-02/24
Tl-208*	GS	0.24±0.08	pCi/g	0.1 02/12-02/24
U-235*	GS	U	pCi/g	0.9 02/12-02/24



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### Gamma Spectroscopy

Sample Id: 12-PVSS-S01  
Lab Id: 981315-39  
Date Sampled: 29-Jan-98

Project: Foster Wheeler  
Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	1.2±0.4	pCi/g	0.5	02/12-02/24
Bi-212*	GS	U	pCi/g	1.9	02/12-02/24
Bi-214*	GS	1.1±0.3	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	12±2	pCi/g	1.8	02/12-02/24
Pb-210*	GS	U	pCi/g	3.2	02/12-02/24
Pb-212*	GS	1.3±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	1.3±0.3	pCi/g	0.3	02/12-02/24
Ra-226*	GS	1.1±0.3	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	2.1	02/12-02/24
Tl-208*	GS	0.4±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	1.0	02/12-02/24

Sample Id: 12-PVSS-S02  
Lab Id: 981315-40  
Date Sampled: 29-Jan-98

Project: Foster Wheeler  
Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.8±0.3	pCi/g	0.4	02/12-02/24
Bi-212*	GS	1.5±0.7	pCi/g	1.1	02/12-02/24
Bi-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	7.4±1.5	pCi/g	1.7	02/12-02/24
Pb-210*	GS	U	pCi/g	2.7	02/12-02/24
Pb-212*	GS	1.0±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.6±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.8	02/12-02/24
Tl-208*	GS	0.25±0.08	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.8	02/12-02/24

**KEMRON**

**Gamma Spectroscopy**

Sample Id: 12-PVSS-S03  
 Lab Id: 981315-41  
 Date Sampled: 29-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	1.1±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.6	02/12-02/24
Bi-214*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	10±2	pCi/g	1.2	02/12-02/24
Pb-210*	GS	U	pCi/g	2.4	02/12-02/24
Pb-212*	GS	1.2±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.8±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.3	02/12-02/24
Tl-208*	GS	0.47±0.09	pCi/g	0.08	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24

Sample Id: 12-PVSS-S04  
 Lab Id: 981315-42  
 Date Sampled: 29-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	1.4±0.4	pCi/g	0.4	02/12-02/24
Bi-212*	GS	U	pCi/g	1.6	02/12-02/24
Bi-214*	GS	1.1±0.2	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.2	02/12-02/24
Cs-134*	GS	U	pCi/g	0.2	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	14±2	pCi/g	1.1	02/12-02/24
Pb-210*	GS	U	pCi/g	3.4	02/12-02/24
Pb-212*	GS	1.6±0.3	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.9±0.3	pCi/g	0.3	02/12-02/24
Ra-226*	GS	1.1±0.2	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	1.7	02/12-02/24
Tl-208*	GS	0.5±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.8	02/12-02/24

KEMRON

Gamma Spectroscopy

Sample Id: 12-PVSS-S05  
 Lab Id: 981315-43  
 Date Sampled: 29-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Bi-212*	GS	U	pCi/g	0.9	02/12-02/24
Bi-214*	GS	0.5±0.1	pCi/g	0.1	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	3.7±0.9	pCi/g	0.8	02/12-02/24
Pb-210*	GS	U	pCi/g	1.7	02/12-02/24
Pb-212*	GS	0.4±0.1	pCi/g	0.1	02/12-02/24
Pb-214*	GS	0.5±0.1	pCi/g	0.1	02/12-02/24
Ra-226*	GS	0.5±0.1	pCi/g	0.1	02/12-02/24
Th-234*	GS	U	pCi/g	0.9	02/12-02/24
Tl-208*	GS	0.24±0.06	pCi/g	0.07	02/12-02/24
U-235*	GS	U	pCi/g	0.5	02/12-02/24

Sample Id: 12-PVSS-S06  
 Lab Id: 981315-44  
 Date Sampled: 29-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	1.1±0.3	pCi/g	0.4	02/12-02/24
Bi-212*	GS	U	pCi/g	1.5	02/12-02/24
Bi-214*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	0.2±0.1	pCi/g	0.1	02/12-02/24
K-40*	GS	8.3±1.9	pCi/g	1.5	02/12-02/24
Pb-210*	GS	U	pCi/g	2.8	02/12-02/24
Pb-212*	GS	1.2±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.8±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.1	02/12-02/24
Tl-208*	GS	0.4±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

KEMRON

Gamma Spectroscopy

Sample Id: 12-PVSS-S07  
 Lab Id: 981315-45  
 Date Sampled: 29-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	1.2±0.4	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.3	02/12-02/24
Bi-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	5.8±0.4	pCi/g	0.1	02/12-02/24
K-40*	GS	6.7±1.3	pCi/g	0.7	02/12-02/24
Pb-210*	GS	U	pCi/g	2.9	02/12-02/24
Pb-212*	GS	1.3±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.9±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.5	02/12-02/24
Tl-208*	GS	0.4±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.8	02/12-02/24

Sample Id: 12-PVSS-S08  
 Lab Id: 981315-46  
 Date Sampled: 29-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.3±0.2	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.1	02/12-02/24
Bi-214*	GS	0.3±0.1	pCi/g	0.1	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	2.1±0.8	pCi/g	1.1	02/12-02/24
Pb-210*	GS	U	pCi/g	1.9	02/12-02/24
Pb-212*	GS	0.6±0.1	pCi/g	0.1	02/12-02/24
Pb-214*	GS	0.3±0.1	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.3±0.1	pCi/g	0.1	02/12-02/24
Th-234*	GS	U	pCi/g	1.0	02/12-02/24
Tl-208*	GS	0.15±0.05	pCi/g	0.08	02/12-02/24
U-235*	GS	U	pCi/g	0.4	02/12-02/24

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Status: Final

**KEMRON****Gamma Spectroscopy****Sample Id: 12-PVSS-S09**  
**Lab Id: 981315-47**  
**Date Sampled: 29-Jan-98****Project: Foster Wheeler**  
**Matrix: Soil**

<u>Analyte</u>	<u>Fraction</u>	<u>Conc. + 2<math>\sigma</math></u>		<u>LLD</u>	<u>Date Analyzed</u>
Ac-228*	GS	0.7±0.2	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.2	02/12-02/24
Bi-214*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	4.1±1.1	pCi/g	1.3	02/12-02/24
Pb-210*	GS	U	pCi/g	2.4	02/12-02/24
Pb-212*	GS	0.8±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.3	02/12-02/24
Tl-208*	GS	0.3±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24

**Sample Id: 12-PVSS-S10**  
**Lab Id: 981315-48**  
**Date Sampled: 29-Jan-98****Project: Foster Wheeler**  
**Matrix: Soil**

<u>Analyte</u>	<u>Fraction</u>	<u>Conc. + 2<math>\sigma</math></u>		<u>LLD</u>	<u>Date Analyzed</u>
Ac-228*	GS	0.9±0.4	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.5	02/12-02/24
Bi-214*	GS	0.9±0.2	pCi/g	0.3	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.2	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	10±2	pCi/g	1.6	02/12-02/24
Pb-210*	GS	U	pCi/g	2.8	02/12-02/24
Pb-212*	GS	1.2±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.9±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.9±0.2	pCi/g	0.3	02/12-02/24
Th-234*	GS	U	pCi/g	1.6	02/12-02/24
Tl-208*	GS	0.4±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.8	02/12-02/24

**KEMRON**

**Gamma Spectroscopy**

Sample Id: 12-PVSS-S11  
 Lab Id: 981315-49  
 Date Sampled: 29-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	1.0±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.2	02/12-02/24
Bi-214*	GS	0.9±0.2	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	8.8±1.5	pCi/g	1.3	02/12-02/24
Pb-210*	GS	U	pCi/g	2.6	02/12-02/24
Pb-212*	GS	1.0±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	1.1±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.9±0.2	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.4	02/12-02/24
Tl-208*	GS	0.4±0.1	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

Sample Id: 12-PVSS-S12  
 Lab Id: 981315-50  
 Date Sampled: 29-Jan-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.8±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.3	02/12-02/24
Bi-214*	GS	0.7±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	7.2±1.3	pCi/g	1.1	02/12-02/24
Pb-210*	GS	U	pCi/g	2.3	02/12-02/24
Pb-212*	GS	1.0±0.2	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.7±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.2	02/12-02/24
Tl-208*	GS	0.33±0.07	pCi/g	0.09	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24

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Status: Final

**KEMRON****Gamma Spectroscopy****Sample Id: 12-PVSS-S13**  
**Lab Id: 981315-51**  
**Date Sampled: 29-Jan-98****Project: Foster Wheeler**  
**Matrix: Soil**

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	0.8±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.0	02/12-02/24
Bi-214*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	U	pCi/g	0.1	02/12-02/24
K-40*	GS	5.0±1.1	pCi/g	0.9	02/12-02/24
Pb-210*	GS	U	pCi/g	2.2	02/12-02/24
Pb-212*	GS	0.8±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.5±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.4±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.2	02/12-02/24
Tl-208*	GS	0.26±0.07	pCi/g	0.08	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24

**Sample Id: 12-BF-28-21/01**  
**Lab Id: 981315-52**  
**Date Sampled: 3-Feb-98****Project: Foster Wheeler**  
**Matrix: Soil**

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	0.8±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.1	02/12-02/24
Bi-214*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	0.3±0.1	pCi/g	0.1	02/12-02/24
K-40*	GS	6.9±1.3	pCi/g	1.4	02/12-02/24
Pb-210*	GS	U	pCi/g	2.0	02/12-02/24
Pb-212*	GS	1.1±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.7±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.4	02/12-02/24
Tl-208*	GS	0.36±0.08	pCi/g	0.09	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24

KEMRON

Gamma Spectroscopy

Sample Id: 12-BF-27-25/01  
 Lab Id: 981315-53  
 Date Sampled: 3-Feb-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.8±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.1	02/12-02/24
Bi-214*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	3.5±0.2	pCi/g	0.1	02/12-02/24
K-40*	GS	4.5±1.1	pCi/g	1.4	02/12-02/24
Pb-210*	GS	U	pCi/g	2.4	02/12-02/24
Pb-212*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.3	02/12-02/24
Tl-208*	GS	0.21±0.07	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.6	02/12-02/24

Sample Id: 12-BF-29-104/01  
 Lab Id: 981315-54  
 Date Sampled: 3-Feb-98

Project: Foster Wheeler  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	1.0±0.3	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.0	02/12-02/24
Bi-214*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	9.8±0.5	pCi/g	0.1	02/12-02/24
K-40*	GS	4.3±0.9	pCi/g	0.8	02/12-02/24
Pb-210*	GS	U	pCi/g	2.4	02/12-02/24
Pb-212*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.5±0.2	pCi/g	0.3	02/12-02/24
Ra-226*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.6	02/12-02/24
Tl-208*	GS	0.26±0.07	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.8	02/12-02/24

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**KEMRON****Gamma Spectroscopy**

Sample Id: 12-WS-54-IS26116ML

Lab Id: 981315-55

Date Sampled: 26-Jan-98

Project: Foster Wheeler

Matrix: Soil

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	0.5±0.2	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	1.2	02/12-02/24
Bi-214*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	6.8±0.4	pCi/g	0.1	02/12-02/24
K-40*	GS	4.9±1.0	pCi/g	0.9	02/12-02/24
Pb-210*	GS	U	pCi/g	2.1	02/12-02/24
Pb-212*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.6±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.3	02/12-02/24
Tl-208*	GS	0.21±0.06	pCi/g	0.08	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

Sample Id: 12-WS-55-IS26150ML

Lab Id: 981315-56

Date Sampled: 15-Jan-98

Project: Foster Wheeler

Matrix: Soil

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	0.6±0.2	pCi/g	0.3	02/12-02/24
Bi-212*	GS	U	pCi/g	0.9	02/12-02/24
Bi-214*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Co-57*	GS	U	pCi/g	0.1	02/12-02/24
Co-60*	GS	U	pCi/g	0.1	02/12-02/24
Cs-134*	GS	U	pCi/g	0.1	02/12-02/24
Cs-137*	GS	8.7±0.4	pCi/g	0.1	02/12-02/24
K-40*	GS	4.4±0.9	pCi/g	0.5	02/12-02/24
Pb-210*	GS	U	pCi/g	2.1	02/12-02/24
Pb-212*	GS	0.5±0.1	pCi/g	0.2	02/12-02/24
Pb-214*	GS	0.5±0.2	pCi/g	0.2	02/12-02/24
Ra-226*	GS	0.6±0.1	pCi/g	0.2	02/12-02/24
Th-234*	GS	U	pCi/g	1.4	02/12-02/24
Tl-208*	GS	0.13±0.06	pCi/g	0.1	02/12-02/24
U-235*	GS	U	pCi/g	0.7	02/12-02/24

KEMRON

QUALITY CONTROL REPORT

Solids

<u>Sample Id</u>	<u>%</u>
Blank	U
LCS (True)	NA
LCS (Found)	NA
LCS % Rec	NA
Duplicate	82.4
Duplicate	83.4
RPD	1.2
Spike % Rec	NA



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## KEMRON

### QUALITY CONTROL REPORT

Sample Id	Ac-228*		Bi-212*	
	GS		GS	
	pCi/g	+ 2σ	pCi/g	+ 2σ
Duplicate	0.7	±0.2		U
Duplicate	0.6	±0.3		U
RER	0.19			NA

KEMRON

QUALITY CONTROL REPORT

Sample Id	Bi-214*	Co-57*	Co-60*	Cs-134*
	GS pCi/g + 2σ	GS pCi/g	GS pCi/g	GS pCi/g
Duplicate	0.4 ±0.1	U	U	U
Duplicate	0.6 ±0.1	U	U	U
RER	0.80	NA	NA	NA

KEMRON

QUALITY CONTROL REPORT

Sample Id	Cs-137*		K-40*	
	GS		GS	
	pCi/g	+ 2σ	pCi/g	+ 2σ
Duplicate	3.0	±0.2	8.1	±1.3
Duplicate	2.9	±0.2	6.0	±1.2
RER	0.10		0.64	



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## KEMRON

### QUALITY CONTROL REPORT

Sample Id	Pb-210*		Pb-212*	
	GS	+ 2σ	GS	+ 2σ
Duplicate	U		0.7 ±0.1	
Duplicate	U		0.6 ±0.1	
RER	NA		0.36	

KEMRON

QUALITY CONTROL REPORT

Sample Id	Pb-214*		Ra-226*		Th-234*
	GS	+ 2σ	GS	+ 2σ	GS
	pCi/g		pCi/g		pCi/g
Duplicate	0.6	±0.2	0.4	±0.1	U
Duplicate	0.5	±0.2	0.6	±0.1	U
RER	0.23		0.80		NA



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## KEMRON

### QUALITY CONTROL REPORT

Sample Id	Tl-208*		U-235*
	GS	+ 2 $\sigma$	GS
	pCi/g		pCi/g
Duplicate	0.32	$\pm 0.07$	U
Duplicate	0.23	$\pm 0.06$	U
RER	0.63		NA



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KEMRON

## QUALITY CONTROL REPORT

Gamma Spec  
GS

Sample Id	pCi/l	+ 2σ
Std (found value)	173	±6
Std (true value)	167	±3
Std % rec.	104	



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Ms. Cindy Arnold  
KEMRON  
109 Starlite Park  
Marietta, Ohio 45750

26-Feb-98  
Page: Q-9

Attn:  
Project: Foster Wheeler

PO #:

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Abbreviations:

Parameters:

Ac-228\* : Actinium 228-MDA reported at 2 sigma  
Bi-212\* : Bismuth 212-MDA reported at 2 sigma  
Bi-214\* : Bismuth 214-MDA reported at 2 sigma  
Co-57\* : Cobalt 57-MDA reported at 2 sigma  
Co-60\* : Cobalt 60-MDA reported at 2 sigma  
Cs-134\* : Cesium 134-MDA reported at 2 Sigma  
Cs-137\* : Cesium 137-MDA reported at 2 Sigma  
K-40\* : Potassium 40-MDA reported at 2 sigma  
Pb-210\* : Lead 210-MDA reported at 2 sigma  
Pb-212\* : Lead 212-MDA reported at 2 sigma  
Pb-214\* : Lead 214-MDA reported at 2 sigma  
Ra-226\* : Radium 226 by Bi-214  
Th-234\* : Thorium 234-MDA reported at 2 sigma  
Tl-208\* : Thallium 208-MDA reported at 2 sigma  
U-235\* : Uranium 235-MDA reported at 2 sigma  
Gamma Spec : Gamma Spectroscopy

Methods:

GS : Gamma Spectroscopy

Units:

% : percent  
pCi/g : picoCuries per gram  
pCi/l : picoCuries per liter

Quality codes:

NA : Not Analyzed  
U : Undetected



26-Feb-98

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Ms. Cindy Arnold  
KEMRON  
109 Starlite Park  
Marietta, Ohio 45750

Attn:  
Project: Foster Wheeler

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**QUALITY CONTROL DATA SHEET**

Received by: kz

Via: Fed Ex

Sample Container Type: 16oz pl jar  
Additional Lab Preparation: 100 Mesh

Parameter	Method	Preservative	Init	Analysis Dates
Solids	CLP SOW	4°C	SSM	02/12-02/15
Gamma Spectroscopy	901.1	None	BS	02/12-02/24

Barringer Laboratories, Inc. will return or dispose of your samples 30 days from the date your final report is mailed, unless otherwise specified by contract. Barringer Laboratories, Inc. reserves the right to return samples prior to the 30 days if radioactive levels exceed our license.



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24-Feb-98

Ms. Cindy Arnold  
KEMRON  
109 Starlite Park  
Marietta, Ohio 45750

Attn:  
Project: Westwood

PO #:

Received: 12-Feb-98 09:35

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**ANALYTICAL REPORT PACKAGE**

CASE NARRATIVE.....i

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QUALITY CONTROL REPORT.....Q-1



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Ms. Cindy Arnold  
KEMRON  
109 Starlite Park  
Marietta, Ohio 45750

Attn:  
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## CASE NARRATIVE

A total of 5 Soil samples were received on 12-Feb-98. As stated in the chain of custody, the samples were run for the following analyses: Solids, Gamma Spectroscopy and Gamma Spec. A table, to cross reference your sample ID to ours, is attached. Our procedures are summarized on the Quality Control Data Sheet.

Quality control standards for organic and inorganic analyses followed the appropriate SW-846 or EPA methodology. Quality control standards for radiochemistry followed our standard operating procedures or contractual requirements.

Signed:

*A. M. ... 2/24/98* ..... *Michael ... 2/27/98*  
Inorganic Manager Radiochemical Manager

Signed:

*C. E. ... 2/24/98*  
Project Review



# BARRINGER LABORATORIES, INC.

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24-Feb-98

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Ms. Cindy Arnold  
KEMRON  
109 Starlite Park  
Marietta, Ohio 45750

Attn:  
Project: Westwood

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Received: 12-Feb-98 09:35

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Lab-ID	Matrix	Client Sample ID	Sampled
981350-1	Soil	12-PVSS-01	8-Jan-98
981350-2	Soil	12-BF-12-12/01	10-Feb-98
981350-3	Soil	12-BF-13-15/01	10-Feb-98
981350-4	Soil	12-NRC-01	6-Feb-98
981350-5	Soil	12-NRC-02	6-Feb-98

**KEMRON**

Sample Id: 12-PVSS-01  
 Lab Id: 981350-1  
 Date Sampled: 8-Jan-98  
 Project: Westwood  
 Matrix: Soil

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Solids		CLP SOW	68.8 %		12-Feb-98

Sample Id: 12-BF-12-12/01  
 Lab Id: 981350-2  
 Date Sampled: 10-Feb-98  
 Project: Westwood  
 Matrix: Soil

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Solids		CLP SOW	94.1 %		12-Feb-98

Sample Id: 12-BF-13-15/01  
 Lab Id: 981350-3  
 Date Sampled: 10-Feb-98  
 Project: Westwood  
 Matrix: Soil

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Solids		CLP SOW	95.1 %		12-Feb-98

Sample Id: 12-NRC-01  
 Lab Id: 981350-4  
 Date Sampled: 6-Feb-98  
 Project: Westwood  
 Matrix: Soil

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Solids		CLP SOW	80.4 %		12-Feb-98

Sample Id: 12-NRC-02  
 Lab Id: 981350-5  
 Date Sampled: 6-Feb-98  
 Project: Westwood  
 Matrix: Soil

Analyte	Fraction	Method	Concentration	MDL	Date Analyzed
Solids		CLP SOW	75.7 %		12-Feb-98

**KEMRON**

**Gamma Spectroscopy**

Sample Id: 12-PVSS-01  
 Lab Id: 981350-1  
 Date Sampled: 8-Jan-98

Project: Westwood  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.6±0.4	pCi/g	0.6	02/16-02/23
Bi-212*	GS	U	pCi/g	1.9	02/16-02/23
Bi-214*	GS	0.8±0.3	pCi/g	0.4	02/16-02/23
Co-57*	GS	U	pCi/g	0.1	02/16-02/23
Co-60*	GS	U	pCi/g	0.2	02/16-02/23
Cs-134*	GS	U	pCi/g	0.2	02/16-02/23
Cs-137*	GS	0.3±0.1	pCi/g	0.2	02/16-02/23
K-40*	GS	5.2±1.9	pCi/g	2.8	02/16-02/23
Pb-210*	GS	U	pCi/g	4.6	02/16-02/23
Pb-212*	GS	0.8±0.2	pCi/g	0.3	02/16-02/23
Pb-214*	GS	0.8±0.3	pCi/g	0.4	02/16-02/23
Ra-226*	GS	0.8±0.3	pCi/g	0.4	02/16-02/23
Th-234*	GS	U	pCi/g	2.5	02/16-02/23
Tl-208*	GS	0.27±0.10	pCi/g	0.1	02/16-02/23
U-235*	GS	U	pCi/g	1.1	02/16-02/23

Sample Id: 12-BF-12-12/01  
 Lab Id: 981350-2  
 Date Sampled: 10-Feb-98

Project: Westwood  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.4±0.2	pCi/g	0.4	02/16-02/23
Bi-212*	GS	U	pCi/g	1.1	02/16-02/23
Bi-214*	GS	0.6±0.1	pCi/g	0.2	02/16-02/23
Co-57*	GS	U	pCi/g	0.1	02/16-02/23
Co-60*	GS	U	pCi/g	0.1	02/16-02/23
Cs-134*	GS	U	pCi/g	0.1	02/16-02/23
Cs-137*	GS	2.5±0.2	pCi/g	0.1	02/16-02/23
K-40*	GS	1.7±0.8	pCi/g	1.4	02/16-02/23
Pb-210*	GS	U	pCi/g	2.2	02/16-02/23
Pb-212*	GS	0.4±0.1	pCi/g	0.2	02/16-02/23
Pb-214*	GS	0.6±0.2	pCi/g	0.3	02/16-02/23
Ra-226*	GS	0.6±0.1	pCi/g	0.2	02/16-02/23
Th-234*	GS	U	pCi/g	1.4	02/16-02/23
Tl-208*	GS	0.13±0.07	pCi/g	0.1	02/16-02/23
U-235*	GS	U	pCi/g	0.6	02/16-02/23

**KEMRON**

**Gamma Spectroscopy**

Sample Id: 12-BF-13-15/01  
 Lab Id: 981350-3  
 Date Sampled: 10-Feb-98

Project: Westwood  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.7±0.3	pCi/g	0.4	02/16-02/23
Bi-212*	GS	U	pCi/g	1.5	02/16-02/23
Bi-214*	GS	0.9±0.2	pCi/g	0.3	02/16-02/23
Co-57*	GS	U	pCi/g	0.1	02/16-02/23
Co-60*	GS	U	pCi/g	0.1	02/16-02/23
Cs-134*	GS	U	pCi/g	0.1	02/16-02/23
Cs-137*	GS	1.3±0.2	pCi/g	0.1	02/16-02/23
K-40*	GS	5.3±1.3	pCi/g	1.5	02/16-02/23
Pb-210*	GS	U	pCi/g	2.4	02/16-02/23
Pb-212*	GS	0.7±0.1	pCi/g	0.2	02/16-02/23
Pb-214*	GS	0.9±0.2	pCi/g	0.2	02/16-02/23
Ra-226*	GS	0.9±0.2	pCi/g	0.3	02/16-02/23
Th-234*	GS	U	pCi/g	1.5	02/16-02/23
Tl-208*	GS	0.25±0.08	pCi/g	0.1	02/16-02/23
U-235*	GS	U	pCi/g	0.7	02/16-02/23

Sample Id: 12-NRC-01  
 Lab Id: 981350-4  
 Date Sampled: 6-Feb-98

Project: Westwood  
 Matrix: Soil

Analyte	Fraction	Conc. + 2σ		LLD	Date Analyzed
Ac-228*	GS	0.7±0.3	pCi/g	0.4	02/16-02/23
Bi-212*	GS	U	pCi/g	1.5	02/16-02/23
Bi-214*	GS	1.0±0.2	pCi/g	0.2	02/16-02/23
Co-57*	GS	U	pCi/g	0.1	02/16-02/23
Co-60*	GS	U	pCi/g	0.1	02/16-02/23
Cs-134*	GS	U	pCi/g	0.1	02/16-02/23
Cs-137*	GS	U	pCi/g	0.1	02/16-02/23
K-40*	GS	16±2	pCi/g	1.4	02/16-02/23
Pb-210*	GS	U	pCi/g	3.0	02/16-02/23
Pb-212*	GS	0.9±0.2	pCi/g	0.2	02/16-02/23
Pb-214*	GS	0.9±0.2	pCi/g	0.2	02/16-02/23
Ra-226*	GS	1.0±0.2	pCi/g	0.2	02/16-02/23
Th-234*	GS	U	pCi/g	1.9	02/16-02/23
Tl-208*	GS	0.34±0.08	pCi/g	0.1	02/16-02/23
U-235*	GS	U	pCi/g	0.8	02/16-02/23

KEMRON

Gamma Spectroscopy

Sample Id: 12-NRC-02

Lab Id: 981350-5

Date Sampled: 6-Feb-98

Project: Westwood

Matrix: Soil

Analyte	Fraction	Conc. + 2 $\sigma$		LLD	Date Analyzed
Ac-228*	GS	1.0±0.4	pCi/g	0.5	02/16-02/23
Bi-212*	GS	U	pCi/g	1.6	02/16-02/23
Bi-214*	GS	1.0±0.2	pCi/g	0.3	02/16-02/23
Co-57*	GS	U	pCi/g	0.1	02/16-02/23
Co-60*	GS	U	pCi/g	0.2	02/16-02/23
Cs-134*	GS	U	pCi/g	0.1	02/16-02/23
Cs-137*	GS	0.7±0.1	pCi/g	0.2	02/16-02/23
K-40*	GS	8.3±1.8	pCi/g	1.8	02/16-02/23
Pb-210*	GS	U	pCi/g	3.2	02/16-02/23
Pb-212*	GS	0.9±0.2	pCi/g	0.2	02/16-02/23
Pb-214*	GS	1.1±0.3	pCi/g	0.3	02/16-02/23
Ra-226*	GS	1.0±0.2	pCi/g	0.3	02/16-02/23
Th-234*	GS	U	pCi/g	2.1	02/16-02/23
Tl-208*	GS	0.40±0.10	pCi/g	0.1	02/16-02/23
U-235*	GS	U	pCi/g	0.8	02/16-02/23



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Job: 981350E  
Status: Final

KEMRON

QUALITY CONTROL REPORT

Solids

<u>Sample Id</u>	<u>%</u>
Blank	U
LCS (True)	NA
LCS (Found)	NA
LCS % Rec	NA
Duplicate	75.7
Duplicate	88.5
RPD	15.5
Spike % Rec	NA



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Job: 981350E  
Status: Final

## KEMRON

### QUALITY CONTROL REPORT

Ac-228*		Bi-212*		Bi-214*	
GS		GS		GS	
Sample Id	pCi/g + 2σ	pCi/g	pCi/g	pCi/g + 2σ	
Duplicate	0.6 ±0.4	U	U	0.8 ±0.3	
Duplicate	0.8 ±0.4	U	U	0.9 ±0.2	
RER	0.24	NA	NA	0.18	

Co-57*		Co-60*		Cs-134*		Cs-137*	
GS		GS		GS		GS	
Sample Id	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	+ 2σ	
Duplicate	U	U	U	U	0.3	±0.1	
Duplicate	U	U	U	U	0.5	±0.1	
RER	NA	NA	NA	NA	0.85		

K-40*		Pb-210*		Pb-212*	
GS		GS		GS	
Sample Id	pCi/g + 2σ	pCi/g	pCi/g	pCi/g + 2σ	
Duplicate	5.2 ±1.9	U	U	0.8 ±0.2	
Duplicate	7.2 ±1.9	U	U	0.8 ±0.2	
RER	0.47	NA	NA	0.00	

**BARRINGER LABORATORIES, INC.**

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24-Feb-98

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Job: 981350E

Status: Final

**KEMRON****QUALITY CONTROL REPORT**

Sample Id	Pb-214*	Ra-226*	Th-234*
	GS	GS	GS
	pCi/g + 2 $\sigma$	pCi/g + 2 $\sigma$	pCi/g
Duplicate	0.8 ±0.3	0.8 ±0.3	U
Duplicate	1.0 ±0.3	0.9 ±0.2	U
RER	0.30	0.18	NA

Sample Id	Tl-208*	U-235*
	GS	GS
	pCi/g + 2 $\sigma$	pCi/g
Duplicate	0.27 ±0.1	U
Duplicate	0.32 ±0.1	U
RER	0.23	NA

KEMRON

QUALITY CONTROL REPORT

Sample Id	Gamma Spec	
	GS	+ 2 $\sigma$
<u>Sample Id</u>	<u>pCi/g</u>	
Std (found value)	177	$\pm 4$
Std (true value)	167	$\pm 3$
Std % rec.	106	



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24-Feb-98

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Ms. Cindy Arnold  
KEMRON  
109 Starlite Park  
Marietta, Ohio 45750

Attn:  
Project: Westwood

PO #:

Received: 12-Feb-98 09:35

Job: 981350E

Status: Final

### Abbreviations:

### Parameters:

Ac-228*	: Actinium 228-MDA reported at 2 sigma
Bi-212*	: Bismuth 212-MDA reported at 2 sigma
Bi-214*	: Bismuth 214-MDA reported at 2 sigma
Co-57*	: Cobalt 57-MDA reported at 2 sigma
Co-60*	: Cobalt 60-MDA reported at 2 sigma
Cs-134*	: Cesium 134-MDA reported at 2 Sigma
Cs-137*	: Cesium 137-MDA reported at 2 Sigma
K-40*	: Potassium 40-MDA reported at 2 sigma
Pb-210*	: Lead 210-MDA reported at 2 sigma
Pb-212*	: Lead 212-MDA reported at 2 sigma
Pb-214*	: Lead 214-MDA reported at 2 sigma
Ra-226*	: Radium 226 by Bi-214
Th-234*	: Thorium 234-MDA reported at 2 sigma
Tl-208*	: Thallium 208-MDA reported at 2 sigma
U-235*	: Uranium 235-MDA reported at 2 sigma
Gamma Spec	: Gamma Spectroscopy

### Methods:

GS : Gamma Spectroscopy

### Units:

%	: percent
pCi/g	: picoCuries per gram

### Quality codes:

NA	: Not Analyzed
U	: Undetected

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Ms. Cindy Arnold  
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Marietta, Ohio 45750

Attn:  
Project: Westwood

PO #:

Received: 12-Feb-98 09:35

Job: 981350E

Status: Final

## QUALITY CONTROL DATA SHEET

Received by: ksz Via: Fed Ex

Sample Container Type: 16 oz pl jar  
Additional Lab Preparation: 100 Mesh

Parameter	Method	Preservative	Init	Analysis Dates
Solids	CLP SOW	None	SSM	02/12-02/15
Gamma Spectroscopy	901.1	None	BS	02/16-02/23

Barringer Laboratories, Inc. will return or dispose of your samples 30 days from the date your final report is mailed, unless otherwise specified by contract. Barringer Laboratories, Inc. reserves the right to return samples prior to the 30 days if radioactive levels exceed our license.

This is to acknowledge the receipt of your letter/application dated

5-7-98, and to inform you that the initial processing which includes an administrative review has been performed.

19-10306-01

There were no administrative omissions. Your application was assigned to a technical reviewer. Please note that the technical review may identify additional omissions or require additional information.

Please provide to this office within 30 days of your receipt of this card

A copy of your action has been forwarded to our License Fee & Accounts Receivable Branch, who will contact you separately if there is a fee issue involved.

Your action has been assigned Mail Control Number 125699.  
When calling to inquire about this action, please refer to this control number.  
You may call us on (610) 337-5398, or 337-5260.

Sincerely,  
Licensing Assistance Team Leader