

December 23, 2002

44278/12

Massachusetts Department of Environmental Protection
Mr. Craig Durrett
1 Winter St., 7th Floor
Boston, MA 02108

**Subject: Focused Uranium Tailings Investigation Report
GSA Property
Former Watertown Arsenal
Watertown, MA**

Dear Mr. Durrett:

On behalf of the US Army Corps of Engineers, New England District, Harding ESE is pleased to submit to you three copies of the Focused Uranium Tailings Investigation Report for the GSA Property.

This report documents the results of the focused uranium tailings investigation conducted at the Watertown GSA Site in September 2002.

Please do not hesitate to call me at (781) 213-5652 should you have any questions or comments related to the enclosed document.

Yours truly,

HARDING ESE



Mark J. Salvetti, P.E.
Project Manager

Enclosure

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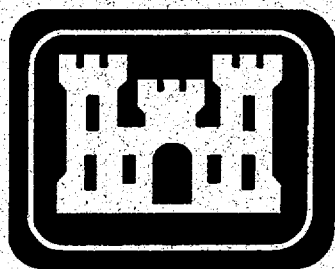
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**U.S. Army Corps
of Engineers®
New England District**

FOCUSED URANIUM TAILINGS INVESTIGATION REPORT

**GSA PROPERTY
FORMER WATERTOWN ARSENAL
WATERTOWN, MASSACHUSETTS**

CONTRACT NO. DACA33-97-C-0023

DERP PROJECT NO. DO1MA001902

DECEMBER 2002



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A MACTEC COMPANY

FOCUSED URANIUM TAILINGS INVESTIGATION REPORT

**GSA PROPERTY
WATERTOWN, MASSACHUSETTS
MADEP SITE NO. 3-2722**

DERP PROJECT NO. DO1MA001902

Prepared for:

Department of the Army
U.S. Corps of Engineers, New England District
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**CONTRACT NUMBER:
DACA33-97-C-0023**

DECEMBER 2002

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This document discusses the results of the uranium and tailings investigation conducted at the Watertown General Services Administration (GSA) site in September 2002. All work was performed in accordance with the Focused Uranium Tailings Investigation Workplan prepared by Harding ESE in June 2002 under Contract Number DACA33-97-C-0023 for the U.S. Army Corps of Engineers, New England District (CENAE). The work described in this document falls under the jurisdiction of the Defense Environmental Restoration Program (DERP) Project No. DO1MA001902 and the Massachusetts Contingency Plan (MCP). The project was conducted under the direction of the CENAE, located at 696 Virginia Road, Concord, Massachusetts, 01742-2751. The CENAE architect/engineer (AE) Engineering Manager is Robert Simeone. Mr. Simeone can be contacted at (978) 318-8713, fax no. (978) 318-8614. The CENAE Project Manager is Mr. Randy Godfrey. Mr. Godfrey can be contacted at (978) 318-8717.

The purpose of this focused investigation is to evaluate the potential presence of residual radioactivity in soil that may have been deposited in fill materials used at the Site and the adjoining Metropolitan District Commission (MDC) Property 20 in Watertown, Massachusetts in connection with historic usage and activities of the U.S. Army and subsequent tenants at the Site. The primary objective of this additional work is to determine whether four soil sample locations previously noted by Argonne National Laboratories (ANL) and Morrison-Knudsen Inc. (MK), and the possible radiological anomalies identified during characterization activities contain uranium tailings material.

Harding ESE reacquired the two MK (FS-01 and FS-07) and two ANL (1-S92 and 1-S95) locations where the radiological anomalies were reported using location data obtained from historical Site figures and a global positioning satellite (GPS) unit. Harding ESE then established a 20' x 20' survey area grid centered over each of the reacquired locations. This survey area was large enough to account for potential discrepancies in pinpointing locations that were sampled up to 20 years ago, and provides an efficient means of evaluating a larger representative area. A series of 10 to 15 timed direct static measurements were made on a systematic grid within the survey grids to establish the mean and the 95 percent upper confidence limit about the mean (UCL₉₅) within each area. A scan investigation level corresponding to 1.5 times the (UCL₉₅) was then established, in accordance with the approved work plan.

A gross gamma scan of the surface of the soil within the 20' x 20' survey area was performed using a 1.5" x 1.5" Sodium Iodide (NaI) detector. Scans were performed to locate the highest gamma count rate readings at the ground surface within the survey area.

In each survey area, a soil sample was then collected from a 0-1 foot interval below ground surface (bgs) at the location with the highest static (time integrated) count rate measurement results, as well as the reacquired historical sample location at the center of the survey area. In addition, soil samples were collected from the 1 to 2 foot interval bgs and submitted for laboratory analysis by both alpha and gamma spectrometry from one location per survey area.

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RESULTS

Each static measurement was collected over a 30-second integrating period and normalized to gamma count rate in units of counts per second (cps). In grid 1-S92, the static gamma count rate measurements ranged from 89 to 106 cps, with a mean of 95 cps. Gamma count rate measurements in Grid FS-01 ranged from 111 to 174 cps, with a mean of 138 cps. Static ground surface measurements in Grid FS-07 yielded a mean gamma count rate of 118 cps with a range from 87 to 217 cps. In Grid 1-S95, the gamma count rate measurements averaged 149 cps with a range extending from 120 to 185 cps. The highest single static gamma count rate measurement (217 cps) was made in Grid FS-07 at node N-16, a value approximately two-times the area "background" count rate. Still, when this value is considered in the context of the expected variability in naturally occurring background, where a variance of $\pm 100\%$ is not uncommon, it is apparent that it is not significant as a radiation hazard in and of itself. Of course, these measurements were made explicitly to establish a sentinel value for the surface scanning survey and to guide or direct the soil sampling efforts that followed such that soil samples would be collected from locations exhibiting the highest gamma radiation signal within the grid. The thirteen static measurements were then used to compute the UCL_{95} in each grid.

Gamma scans of the ground surface were then performed in each of the four grids. The scanning was conducted with the instrument being moved forward at a slow walking pace while simultaneously being swung from side to side in order to scan the entire grid area. Of all the scan survey results, only one location yielded a gamma count rate measurement in excess of the scanning sentinel criterion. That measurement occurred in Grid FS-07 where a maximum gamma count rate of 220 cps was located. This spot was isolated to a relatively small area immediately adjacent to the grid node N-16 in the grid. The 220 cps scan result from this location was consistent with the timed static count rate measurement previously acquired at node N-16 (217 cps). All other scan survey measurements produced gamma count rates less than the sentinel criterion.

Soil samples were collected following the completion of the surface scans. Samples were collected using a stainless-steel bucket auger, and stainless steel bowls and spoons. An appropriate sample volume was collected in a Number 10 sieve, and then sieved into a stainless steel bowl. Soil samples were sieved to separate larger pieces from the soil in general in an effort avoid interference that might arise due to the possible presence of a DU chip in the sample. Tailings, if present, would be present in small particle size.

Samples were packaged in the field and tightly sealed in marinelli containers specifically designed to make isotopic gamma spectroscopy measurements. Following a minimum ten day in-growth period to ensure secular equilibrium of radon and thoron progeny in the decay series, the samples were analyzed for gamma emitting isotopes in the ^{238}U , ^{235}U , and ^{232}Th decay series. After the gamma spectroscopy analysis was completed, each sample container was opened and prepared for alpha spectroscopy analysis. An aliquot of soil from each sample was analyzed via alpha spectroscopy.

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Tailings resulting from uranium extraction from ore would be depleted in concentrations of ^{238}U and ^{234}U (plus protactinium-234m and ^{234}Th) whereas ^{230}Th , ^{226}Ra , and radon progeny would be expected to be in equilibrium with one another and in concentrations higher than that of ^{238}U . Thorium tailings are residues from the extraction of ^{232}Th and ^{228}Th from thorium ores. As a result, thorium tailings would be depleted in thorium isotopes but would be expected to have equilibrium concentrations of ^{228}Ra and ^{228}Ac higher than that of ^{232}Th . Gamma spectral analysis of the samples collected from the four sample grids consistently indicates the presence of natural uranium and thorium isotopes in secular equilibrium. This suggests that neither uranium nor thorium tailings are present at the locations sampled.

A soil sample collected from the ground surface (0 to 1 foot depth increment) in Grid FS-01, node H-14, appears to have slightly elevated concentrations of natural thorium activity in secular equilibrium (indicating natural occurrence). The sample was collected at the location within the grid with the highest recorded static gamma count rate measurement, 174 cps. The gamma radiation fluence from ^{232}Th readily accounts for the ground surface gamma count rate measurement in this grid. The soil sample collected from the 1 to 2 foot bgs depth increment at this same location has ^{232}Th decay series activity in concentrations consistent with background.

Samples collected at node I-4 in Grid 1-S95 indicate the presence of slightly elevated concentrations of natural uranium series isotopes. The concentrations of uranium series radionuclides in these samples are approximately 5 to 7 pCi/g. These were again collected at the location within the grid with the highest recorded static gamma count rate measurement, 186 cps. Given that the uranium isotopes are in equilibrium, and that the sample was collected from the location having the highest gamma count rate within the grid, these concentrations are not significant as radiological hazards. The gamma radiation fluence from ^{226}Ra readily accounts for the ground surface gamma count rate measurement in this grid.

The location with the highest gamma count rate measurement (and surface scan measurement) in Grid FS-07 was located at node N-16 (217cps). Samples collected at this location again indicate the presence of natural uranium with its isotopes in equilibrium. This sample is unique among those collected in that it indicates concentrations of ^{238}U and its progeny ranging between 12 and 16 pCi/g. This activity is higher than average concentrations of natural radioactivity found in typical background soils. However, this activity is apparently limited to a relatively small area as indicated by the localized presence of the corresponding elevated gamma count rate.

Samples collected from within Grid 1-S92 indicate no isotopes that are either elevated in comparison with concentrations expected in natural background in soils or in disequilibrium with the parent uranium or thorium isotopes. No evidence was uncovered in the gamma spectroscopy analysis that would suggest the presence of elevated radioactivity. This is consistent with the fact gross gamma count rate measurements in the grid also indicated no elevated readings.

The alpha spectroscopy analyses yielded unexpected results, as they are inconsistent with the gamma spectroscopy results, while being internally consistent. This discrepancy between alpha spectroscopy and gamma spectroscopy results is apparent in most of the samples analyzed. Harding ESE consulted with the analytical laboratory that performed the analyses to discuss the apparent discrepancy. After reviewing the quality assessment and control for the analyses, it was determined that the gamma spectroscopy results were valid, internally consistent, and consistent

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with activity concentrations expected in soil samples collected in locations with elevated gross gamma count rate readings on the ground surface.

In the opinion of the analytical chemists at the contract laboratory, the most likely reason for the discrepancy is related to the digestion step used to render the species of concern (e.g., uranium) in a chemical form that can be readily extracted from solution. It is possible that the chemicals and processes used in the laboratory to digest the soil particle matrix and break uranium chemical bonds were ineffective at completely digesting the sample or a portion of it. Laboratory reanalysis of several of the soil samples produced results consistent with the previous alpha spectroscopy results, leaving the alpha spectroscopy results uncertain. Harding ESE and the Corps have not used the alpha spec results to draw conclusions in this report about the radiological conditions in the survey grids considered.

CONCLUSIONS

In grids FS-01, FS-07, and 1-S95, gamma radiation measurements point to a slightly elevated gamma fluence. Soil samples, biased to collect samples from locations yielding the highest gamma radiation signals, indicate the presence of slightly elevated concentrations of natural radioactivity in soil. The sample results show that it is not credible to consider that tailings of uranium or thorium ores might be responsible for the localized gamma radiation signals detected in these grids. The explanation for the slightly elevated gamma signals detected is the presence of slightly elevated concentrations of natural radioactivity in soils.

None of the field radiation measurements performed in Grid 1-S92 gave indication of the presence of elevated or anomalous gamma radiation levels, suggesting that tailings are not present. Soil sample data from Grid 1-S92 corroborate the findings suggested by the gamma measurements, again showing that tailings are not present and that radionuclides present in the soil sampled are consistent with that expected in background soils having naturally occurring radioactivity. Harding ESE concludes that no further sampling or investigation relative to the constituency of radioactive isotopes is warranted or necessary in this grid.

Given the history of the site, and the fact that this portion of the site was filled to achieve the current grade, it seems reasonable to conclude that the elevated concentrations of natural radioactivity in soils are associated with the fill material. The elevated natural radioactivity is associated with the small particle size fraction as evidenced by the fact that: 1) the soil samples were sieved in the field to remove large particle size fractions, 2) the large fraction was consistently found to have little or no measurable radioactivity, and 3) the small size fraction was found to have radioactivity concentrations corollary to the gamma ground surface measurements. These circumstances point to the possibility that naturally occurring radioactivity in coal ash known to be a constituent of the fill materials used at the site may be responsible for the radioactivity measured.

Whatever the source, it is clear that the radioactivity in the soil sampled in the four grids is naturally occurring and that tailings are not responsible for the anomalies previously reported on by MK and ANL.

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Soil sampling was biased to ensure that samples were collected from the locations that were likely to have the highest radioactivity in soil. This suggests that the soil samples collected provide a reasonable estimate of the upper bound of natural radioactivity in soil in the backfilled area of Property 20. Harding ESE recommends that all existing ^{226}Ra data from this area be considered in conjunction with this new data to determine whether additional data is necessary to demonstrate compliance with the soil Derived Concentration Guideline Level Report (DCGL). Should data gaps be found, additional, statistically-based sampling should be completed to address those data gaps.

1 INTRODUCTION

Harding ESE completed the Focused Uranium Tailings Investigation at the Watertown General Services Administration (GSA) Property (the Site) between September 5 and September 12, 2002. This investigation was conducted in accordance with the Focused Uranium Tailings Investigation Workplan prepared by Harding ESE in June 2002 under Contract Number DACA33-97-C-0023 for the U.S. Army Corps of Engineers, New England District (CENAE) for the performance of work described in the Amendment to Statement of Work - Supplemental Work for Phase II Comprehensive Site Assessment (CSA) at GSA Property - Watertown, Massachusetts (the Site), dated August 8, 2001. The work described in this document falls under the jurisdiction of the Defense Environmental Restoration Program (DERP) Project No. DO1MA001902 and the Massachusetts Contingency Plan (MCP). The project was conducted under the direction of the CENAE, located at 696 Virginia Road, Concord, Massachusetts, 01742-2751. The CENAE architect/engineer (AE) Engineering Manager is Robert Simeone. Mr. Simeone can be contacted at (978) 318-8713, fax no. (978) 318-8614. The CENAE Project Manager is Mr. Randy Godfrey. Mr. Godfrey can be contacted at (978) 318-8717.

The purpose of this focused investigation is to evaluate the potential presence of residual radioactivity in soil that may have been deposited in fill materials used at the Site and the adjoining Metropolitan District Commission (MDC) Property 20 in Watertown, Massachusetts in connection with historic usage and activities of the U.S. Army and subsequent tenants at the Site. The primary objective of this additional work is to determine whether four soil sample locations previously noted by Argonne National Laboratories (ANL) and Morrison-Knudsen Inc. (MK), and the possible radiological anomalies identified during characterization activities contain uranium tailings material (Harding ESE, 2002).

All work was conducted in accordance with the requirements of the Massachusetts Department of Environmental Protection (MADEP), the Massachusetts Department of Public Health (MADPH) and the United States Nuclear Regulatory Commission (NRC) in an environmentally acceptable manner conforming to existing federal, state, and local laws and regulations, including the MCP (MCP; 310 CMR 40.0000) as revised through October 29, 1999.

ANL (in 1981) and MK (in 1995) reported anomalous detections of Radium-226 (^{226}Ra) in soil at three locations. Both ANL and MK speculated that the ^{226}Ra might be due to the presence of uranium tailings. Massachusetts Institute of Technology (MIT) and American Cyanamid conducted uranium ore research at the nearby Arsenal Site in the late 1940s. However, there is no evidence that tailings were ever brought to or disposed of at the Site.

This summary outlines the rationale for the additional screening and sampling presented in this document, the basis for the selection of sampling locations, and the analytical parameters and results, and describes the specifics of the field program procedures. This document also provides the laboratory analytical procedures and methods, as well as describing the data management and quality assurance and quality control (QA/QC) procedures followed in the execution of the sampling plan.

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2 SUMMARY OF PAST WORK

Information presented in this section was primarily derived from the Preliminary Assessment (PA) of the Former Watertown Arsenal (ABB-ES, 1993), the Historical Site Assessment (HSA) (Harding ESE, 2000), and the Draft Final CSA (Harding ESE, 2001). The following discussion summarizes the ANL and MK investigations completed between 1981 and 1994:

- In 1981, ANL performed a radiological survey of the GSA Property under the Department of Energy's (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP). The work was performed in July through September 1981 and is documented in a report to the DOE dated October 1983. This survey was performed because documentation contained in Atomic Energy Commission (AEC) and U.S. NRC records from previous radiological surveys was insufficient to determine whether previous Army Materials Research Command (the former operator) decontamination procedures were sufficient to meet more recent NRC standards.

ANL's 1983 report describes the results of uranium fluorometric and gamma spectrometric analyses of soil samples collected from locations 1-S92 and 1-S95 as being indicative of the presence of uranium tailings material. These two bore holes contained what was reported as elevated amounts of ^{226}Ra (decay chain) in concentrations that were not in equilibrium with its parent Uranium-238 (^{238}U), indicating the presence of ^{226}Ra with daughters or "tailings" material (i.e., material remaining after the uranium has been chemically separated from ore). The highest ^{226}Ra concentration was found in the first two feet of boring 1-S92, at 13.66 picocuries per gram (pCi/g). Concentrations of ^{226}Ra in boring 1-S95 were less (5.04 pCi/g) but were considered elevated by ANL. (ANL, 1983)

- Beginning in January 1993, MK performed soil remediation and site characterization activities at the GSA Property (Harding ESE, 2000). In a July 1994 Work Plan for Additional GSA Site Characterization, MK identified additional efforts which would be required to complete the radiological characterization of the site. These efforts included evaluation of Property 20, the radiological characterization of Building 653, sediment sampling in Manhole #147, determining the extent of radiological contamination remaining near the burn area, estimating the amount of remaining DU chips at the site, radiological surveys of Areas II and V (the clinker area and Property 20), and evaluation of whether former DU stabilization activities led to windborne deposition of radiological contamination. The effort to complete the characterization of the burn area included the sampling of wells B-25 and B-31, installed in the vicinity of the burn area in October 1993.

Two addenda were added to MK's document, in January of 1996, and in November of 1997. The 1996 addendum addressed additional in-situ gamma spectroscopy which was completed along the site boundary and in the site interior which had previously been surveyed for DU chips and/or non-specific exposure rate. The 1997 addendum provides calculations detailing the background uranium concentration on the site, the total activity of the uranium on the site, and estimates of the potential for groundwater contamination by uranium at the site. Results are summarized in the Historical Site Assessment (Harding ESE, 2000).

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SECTION 2

With respect to tailings, MK's 1996 report speculated that tailings material might be present at location FS-01, based on their interpretation of the ^{226}Ra and thorium-234 (^{234}Th) data for soil collected from this location (MK, 1996). MK reported 19.7 pCi/g of ^{226}Ra and 13 pCi/g of ^{234}Th in surface soil samples at FS-01.

In June 2002, MADEP requested former MK sampling location FS-07 be added to the scope of the tailings investigation. MK reported a ^{226}Ra concentration of 21.8 pCi/g at this location.

3 OBJECTIVES

The primary objective of this investigation is to determine whether historic anomalous screening and sample data from four locations at the northern and western edges of the Site are reproducible and are due to the possible presence of uranium tailings at the Site.

As noted above, previous investigations conducted by ANL in 1983 and MK in 1996 reported four locations at the western edge of the GSA Site and in Property 20 with anomalous isotopic ratios that may be indicative of uranium tailings material. These locations include the ANL locations 1-S92 and 1-S95 as well as the MK locations FS-01 and FS-07 (locations shown on Figure 1, attached). However, it is believed that ANL's and MK's conclusions that tailings may be present at the GSA Site may have been based on an incorrect interpretation of the available data.

In the MK surveys, a gamma spectral analysis was employed to measure the amount of residual radioactivity in soil and in water. The ^{234}Th gamma signal served as an index, or surrogate for ^{238}U , since ^{238}U does not have a suitable gamma signal at concentrations encountered at the GSA site to be measured directly. A ^{234}Th surrogate alone is appropriate, credible, and does not diminish the value of the data collected for determining the concentration of ^{238}U present in soil. However, the data collected was also used to provide input to an algorithm used to determine whether the radionuclide profile was indicative of DU (essentially pure elemental uranium stripped of uranium 235 (^{235}U) nuclides) or alternatively, indicated the presence of uranium in its natural isotopic ratios in some equilibrium association with its progeny. At low concentrations of ^{238}U (i.e., concentrations near background), analytical uncertainty, the natural variability in the background concentrations of ^{235}U , ^{238}U , ^{234}Th , and ^{226}Ra nuclides, and the variability in the elemental and isotopic purity of DU make the distinction between DU and other radionuclide profiles (such as those characteristic of uranium tailings) a difficult task. In the case of the location reported by MK as potentially having uranium tailings materials in soil, a peak stripping algorithm was used to attribute portions of a common photo-peak shared by both ^{226}Ra and ^{235}U . Use of this algorithm assigned activity to ^{226}Ra rather than ^{226}Ra being discretely measured.

Harding ESE reacquired the four MK and ANL locations where anomalous ^{226}Ra concentrations were reported using location data obtained from historical Site figures and a global positioning satellite (GPS) unit. Harding ESE then established a 20' x 20' survey area grid centered over each of the reacquired locations. This survey area was large enough to account for potential discrepancies in pinpointing locations that were sampled up to 20 years ago, and provides an efficient means of evaluating a larger representative area. A series of 10 to 15 timed direct static measurements were made on a systematic grid within the survey grid to establish the mean and the 95 percent upper confidence limit about the mean (UCL₉₅) within the area. A scan investigation level corresponding to 1.5 times the (UCL₉₅) was then established (Harding ESE, 2002).

Next, a gross gamma scan of the surface of the soil within the 20' x 20' survey area was performed using a 1.5" x 1.5" Sodium Iodide (NaI) detector. Scans were performed to locate the highest gamma count rate readings at the ground surface within the survey area.

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SECTION 3

In each survey area, a soil sample was collected from a 0-1 foot interval below ground surface (bgs) at the location with the highest static (time integrated) count rate measurement results, as well as the reacquired historical sample location at the center of the survey area. In addition, soil samples were collected from the 1 to 2 foot interval bgs and submitted for laboratory analysis by both alpha and gamma spectrometry from one location per survey area.

4 FIELD PROCEDURES

4.1 SITE PREPARATION

Site preparation required prior to implementing the focused uranium tailings investigation included reacquisition of former sampling locations using a global positioning system, clearing of brush and small trees, and gridding and flagging of the areas surrounding the former sample locations.

4.2 GPS LOCATION OF SAMPLES

On June 25, 2002, Harding ESE used a portable Trimble GPS Unit to reacquire sample locations identified by MK and ANL as having anomalous radiological results potentially indicative of the presence of uranium tailings materials. Coordinates for ANL locations 1-S92 and 1-S95 were extracted from existing site drawings using AutoCAD. MK locations FS-01 and FS-7 were previously surveyed and the coordinates reported by MK. Coordinates for each location (in MA State Coordinate Plane, NAD1927) are:

<u>Location</u>	<u>Northing</u>	<u>Easting</u>
1-S92	497423.6	695171.3
1-S95	497459.3	695441.6
FS-01	497438.4	695445.5
FS-07	497451.4	695459.7

The locations were staked and are shown on Figure 1.

4.3 CLEARING

The four sampling locations were all heavily overgrown with brush, vines, small trees, etc., and clearing was required in order to establish sampling grids and allow access to the ground surface for scanning. On September 5, the four locations were cleared by Fleet Environmental, with Jeffrey Lively, a MACTEC health physicist, present to provide radiological support. Vegetation in each 20 ft. by 20 ft. grid was cleared to within 3 inches of the ground surface using hand equipment following the conclusion of a site-specific radiological briefing conducted by Mr. Lively. In accordance with the Order of Conditions in effect for work within the wetland areas, no heavy equipment was brought onsite, no refueling operations were conducted in the work area, and, trees with diameters in excess of three inches at 1 meter height were not cleared. Brush that was cleared from the locations was stockpiled onsite adjacent to the sample grids. Photographs are included in Appendix C.

4.4 GRID MARKING

On September 10, Harding ESE returned to the site to demarcate the survey grids using pin flags. Pin flags were set in 2 ft. by 2 ft. squares within the 20 ft by 20 ft grids centered about the former

SECTION 4

sample locations. Survey grid layouts are shown in Figures 1 and 2, and in photographs included in Appendix C.

4.5 RADIOLOGICAL SURVEY

Soil surveying and sample collection was conducted on September 11, 2002. Harding ESE personnel, Jeffrey Lively (MACTEC), Craig Durrett of the Massachusetts Department of Environmental Protection (MADEP), and John Robinson, a health physicist under contract to MADEP met at the Site to commence the survey. Mr. Lively conducted a tailgate safety briefing, including a description of the potential radiological hazards and controls in use at the Site. Hans Honerlah, of the U.S. Army Corps of Engineers, was also present at the site during a portion of the scanning and sampling activities.

4.6 GAMMA EXPOSURE SURVEY

A general area gamma exposure rate survey of sample locations FS-01, FS-07, 1-S95, and 1-S92 was conducted using a BICRON MicroRem meter (serial number C607J, calibrated on 6/12/02) at 1 meter height above the ground surface. This survey indicated dose rates ranging from 6 to 11 microrem/hour ($\mu\text{R/hr}$). Dose rates for the grid locations are illustrated on Figures 3 and 4.

4.7 STATIC GAMMA COUNT MEASUREMENTS AND UCL_{95} CALCULATION

Following the general area gamma exposure rate survey, a 1.5 in by 1.5 in. sodium iodide (NaI) gamma probe coupled with an Eberline E600 survey meter was used to collect 30-second static gamma count rates at 13 locations in each grid. These measurements, which are shown on Figures 5 and 6, were used to determine the value of 1.5 times the UCL_{95} about the mean, which was used as the sentinel criterion for the subsequent surface soil scanning survey.

The UCL_{95} was calculated using the following equation:

$$UCL_{95} = \bar{X} + t_{(n-1)} \left(\frac{S_{\bar{X}}}{\sqrt{n}} \right)$$

where: \bar{X} is the mean of the data;

$S_{\bar{X}}$ is the sample standard deviation;

n is the sample size; and

t is the value from the t-table corresponding to the specified confidence and $(n - 1)$ degrees of freedom.

In each survey area, a soil sample was collected from a 0-1 foot interval bgs at the location with the highest static (time integrated) count rate measurement results, as well as the reacquired historical sample location at the center of the survey area. Only one location with a count rate in

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SECTION 4

excess of 1.5 times the UCL_{95} was detected at grid point N-16 in the FS-07 grid, and a sample was collected from this location as the highest static measurement location in that grid. In addition, soil samples were collected from the 1 to 2 foot interval bgs and submitted for laboratory analysis by both alpha and gamma spectrometry from one location per survey area. Thus, three physical soil samples were collected from each of the three study areas.

4.8 GAMMA SCAN SURVEY OF THE GROUND SURFACE

Once the sentinel criteria had been established, the ground surface in each of the four grids was scanned using the NaI probe and E600 meter. The scanning was conducted at the ground surface, with the instrument being moved forward at a slow walking pace while simultaneously being swung from side to side in order to scan the entire grid area. Results are shown on field data sheets included in Appendix A.

4.9 SOIL SAMPLE COLLECTION

Following the completion of the surface scanning, soil samples were collected. Samples were collected from 0-1 ft. bgs at each of the reacquired previous sample locations. In addition, samples were collected from 0-1 ft. and 1-2 ft. bgs at the grid node with the highest static measurement in each of the grids. Since the only location with an exceedance of the sentinel criterion was immediately adjacent to grid node N-16, the node with the highest static measurement in its grid (FS-07), the 0-1 ft. and 1-2 ft. soil samples were taken at that location. The sample identifications and locations are shown in Figures 5 and 6.

4.9.1 Sampling Methodology

Samples were collected using a stainless-steel bucket auger, and stainless steel bowls and spoons. As noted in the approved work plan (Harding ESE, 2002) the appropriate sample volume was collected in a Number 10 sieve, and then sieved into a stainless steel bowl. Soil samples were sieved to separate larger pieces from the soil in general in an effort avoid interference that might arise due to the possible presence of a DU chip in the sample. Tailings, if present, would be present in small particle size.

The large fraction remaining in the sieve was stockpiled separately and screened with a Ludlum Model 44-9 beta-gamma "pancake" detector probe coupled with a Ludlum Model 12 survey instrument. If the large fraction from the sample indicated any radiation elevated above the surrounding background readings, the large fraction was collected in an 8 oz. glass jar to be submitted for alpha and gamma spectroscopic analysis along with the sieved fraction. The large fraction of the sample collected from 1-2 ft. bgs at SS-56 had a beta-gamma count rate approximately 50-60 counts per minute (cpm) above a background of 100-120 cpm, as measured with the Ludlum Model 12 instrument. The large fraction from this sample was packaged in an 8 oz. glass jar for alpha and gamma spectroscopic analysis, as described above. All sampling equipment was decontaminated using deionized water and a scrub-brush between sample locations.

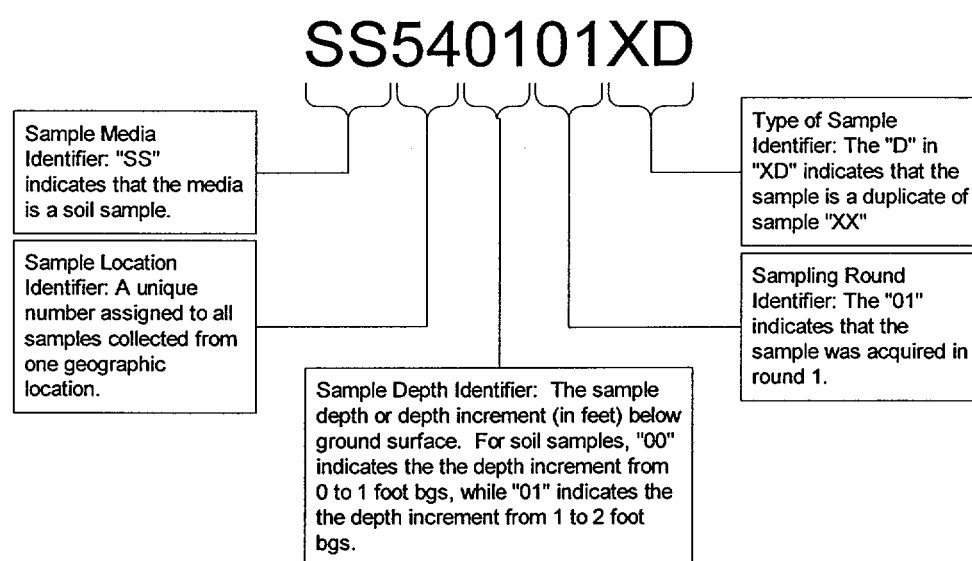
The smaller, sieved sample fractions were packed into marinelli jars using the aluminum tamper. Once the jar had been densely packed, the lid was sealed onto the jar using electrical tape. The

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samples were submitted to Severn Trent Laboratory's St. Louis, Missouri laboratory for analysis by alpha and gamma spectroscopy. Alpha spectroscopic results were specified for the uranium and thorium series isotopes, with a specified 2-sigma detection limit of 0.1 pCi/g per alpha-emitting isotope. Gamma spectroscopic results were specified for the uranium, radium, and thorium series isotopes, with a specified 2-sigma detection limit of 0.5 pCi/g per gamma-emitting isotope.

Sample identifications include the designation "SS" for a surface soil sample, followed by a two-digit number representing the sample location, followed by two digits indicating the depth of the top of the sample, followed by two digits indicating the sampling round, followed by an identifier for the type of sample:



4.9.2 Soil Sample Locations

SS530001XX was collected from the reacquired location of FS-01, and SS540001XX and SS540101XX were collected at grid point H-14. SS550001XX was collected from the reacquired location of 1-S95, and SS560001XX, SS560101XX, and SS560101XL were collected at grid point I-4. SS560101XL consisted of the large fraction sieved from the 1-2' depth of the sample location, which was the only large fraction which produced a slightly elevated reading (50-60 cpm above a background of approximately 100-120 cpm) on the beta-gamma pancake probe. SS570001XX was collected from the reacquired location of FS-07, and SS580001XX, SS580001XD, SS580101XX, and SS580101XD were collected from grid point N-16, the location both of the highest static measurement in the FS-07 grid and the only sentinel criterion exceedance. SS590001XX and SS590101XX were collected from the reacquired location of 1-S92, and SS600001XX was collected from 1-S92 grid location B-10.

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Sample locations are illustrated in Figures 4 and 5, and described in the following Table 4-1:

Table 4-1 Soil Sample Locations

SS530001XX	FS-01
SS540001XX (and MADEP Split) SS540101XX (and MADEP Split)	FS-01 Grid Point H-14
SS550001XX	1-S95
SS560001XX SS560101XX (and MADEP Split) SS560101XL (Coarse Fraction of 1-2 ft interval)	1-S95 Grid Point I-4
SS570001XX	FS-07
SS580001XX SS580001XD (Duplicate) SS580101XX (and MADEP Split) SS580101XD (Duplicate)	FS-07 Grid Point N-16
SS590001XX (and MADEP Split) SS590101XX	1-S92
SS600001XX	1-S92 Grid Point B-10

4.9.3 MADEP Split Sampling

John Robinson collected split samples for MADEP, to be analyzed by the MADPH laboratory in Jamaica Plain, Massachusetts, from sample locations SS540001XX, SS540101XX, SS560101XX, SS580101XX, and SS590001XX. Split sample results have not been provided, and are not discussed within this report.

4.10 DECONTAMINATION AND SCREENING

All sampling equipment was decontaminated between locations using a deionized water rinse. During intrusive, soil sampling activities, sampling personnel wore rubber overboots and nitrile gloves. All personal protective equipment (PPE) was screened using the beta-gamma probe and disposed of as solid waste. None of the surveys indicated radiological activity above the background measurement.

5 RESULTS

Survey and sampling results consist of three components: 1) General area gamma radiation levels, 2) Gamma radiation levels on contact with the ground surface, and 3) Isotopic analysis of discrete soil samples submitted for laboratory analysis. The results of each component are discussed below. A data summary and copies of the laboratory data sheets are included in Appendix B.

5.1 GENERAL AREA GAMMA RADIATION LEVELS

The general area gamma radiation surveys were performed as described in section 4.6 above. Thirteen measurements were made in each of the four grids under investigation (Figures 3 and 4). On average, the general area gamma radiation level in Grid 1-S92 was 6 microrem/hour (consistent with the general area background measured at other locations on site), while the average general area gamma radiation levels in Grids 1-S95, FS-01, and FS-07 were 9, 9, and 8 microrem/hour, respectively. Grids FS-01, FS-07, and 1-S95 are clustered together and straddle the property boundary line of Property 20 near the northeast corner of the site. The average general area gamma radiation levels in these grids are marginally distinguishable from, and slightly in excess of the general area gamma radiation level measured at other locations on the site. Still, 8 to 9 microrem/hour is not excessive. These values are within the range of general area gamma radiation levels that might be expected simply from background radiation in New England.

5.2 GROUND SURFACE GAMMA RADIATION LEVELS

Two different ground surface gamma measurement techniques were used in an attempt to identify and isolate the locations within the four survey grids where the highest concentrations of radioactivity in soil might be found. Ground surface gamma radiation levels were first measured by performing timed static measurements at 13 grid node points in each of the four grids under consideration as described in section 4.7 above. Following these, a gamma scan survey of the soil surface as described in section 4.7.1 above was systematically performed over the entire ground surface within each survey grid.

5.2.1 Static Gamma Count Rate Measurement Results

Each measurement was collected over a 30-second integrating period and normalized to gamma count rate in units of counts per second (cps). Figures 4 and 5 show the values measured at each node within the grids.

In grid 1-S92, the static gamma count rate measurements ranged from 89 to 106 cps, with a mean of 95 cps. Gamma count rate measurements in Grid FS-01 ranged from 111 to 174 cps, with a mean of 138 cps. Static ground surface measurements in Grid FS-07 yielded a mean gamma count rate of 118 cps with a range from 87 to 217 cps. In Grid 1-S95, the gamma count rate measurements averaged 149 cps with a range extending from 120 to 185 cps. The highest single static gamma count rate measurement (217 cps) was made in Grid FS-07 at node N-16, a value approximately two-times the area "background" count rate. Still, when this value is considered in the context of the expected variability in naturally occurring background, where a variance of \pm

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100% is not uncommon, it is apparent that it is not significant as a radiation hazard in and of itself. Of course, these measurements were made explicitly to establish a sentinel value for the surface scanning survey and to guide or direct the soil sampling efforts that followed such that soil samples would be collected from locations exhibiting the highest gamma radiation signal within the grid.

The thirteen static measurements were then used to compute the UCL_{95} in each grid. The mean, the UCL_{95} , and the scanning sentinel (1.5 times the UCL_{95}) along with the number of measurements and the sample standard deviation are presented in Table 5-1 for each of the four grids surveyed.

Table 5-1. Parameters Used to Calculate the Soil Scanning Sentinel Value

Grid	n, number of measurements	Mean	Sample Std. Deviation	UCL_{95}	Scanning Sentinel
FS-01	13	137.6	18.4	149	223
FS-07	13	118.3	36.5	141	211
1-S95	13	148.9	17.5	160	240
1-S92	13	95	5	98	147

5.2.2 Gamma Scan Survey Results

Gamma scans of the ground surface were performed in each of the four grids. Of all the scan survey results, only one location yielded a gamma count rate measurement in excess of the scanning sentinel criterion. That measurement occurred in Grid FS-07 where a maximum gamma count rate of 220 cps was located. This spot was isolated to a relatively small area immediately adjacent to the grid node N-16 in the grid. The 220 cps scan result from this location was consistent with the timed static count rate measurement previously acquired at node N-16 (217 cps). All other scan survey measurements produced gamma count rates less than the sentinel criterion.

5.3 ISOTOPIC ANALYSES OF SOIL SAMPLES

Soil samples were collected from two node locations within each of the four grid areas under consideration as described in Section 4.9.2 above. In each case, one of the samples was collected from the center point of the grid, representing the ANL or MK sample location as reacquired by global positioning measurement. The second sample was collected from the grid node location with the highest gamma count rate measurement. In addition to samples collected from the ground surface (the 0 to 1 foot depth increment), a deeper sample from the 1 to 2 foot bgs depth increment was collected at the grid node with the highest gamma count rate measurement. Thus at least three samples were collected and analyzed from each of the four grids. In addition to these three samples, the large particle size fraction from one sample was found to have slightly elevated activity as measured with the beta/gamma pancake frisker probe and was also submitted for isotopic analysis. Split (duplicate) samples were also collected at a number of locations; some were provided to the MADEP for independent analysis while others were submitted as blind duplicates to the laboratory used by Harding ESE.

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Samples were packaged in the field and tightly sealed in marinelli containers specifically designed to make isotopic gamma spectroscopy measurements. Following a minimum ten day in-growth period to ensure secular equilibrium of radon and thoron progeny in the decay series, the samples were analyzed for gamma emitting isotopes in the ^{238}U , ^{235}U , and ^{232}Th decay series. After the gamma spectroscopy analysis was completed, each sample container was opened and prepared for alpha spectroscopy analysis. An aliquot of soil from each sample was analyzed.

5.3.1 Gamma Spectroscopy Results

Tailings resulting from uranium extraction from ore would be depleted in concentrations of ^{238}U and ^{234}U (plus protactinium-234m and ^{234}Th) whereas ^{230}Th , ^{226}Ra , and radon progeny would be expected to be in equilibrium with one another and in concentrations higher than that of ^{238}U . Thorium tailings are residues from the extraction of ^{232}Th and ^{228}Th from thorium ores. As a result, thorium tailings would be depleted in thorium isotopes but would be expected to have equilibrium concentrations of ^{228}Ra and ^{228}Ac higher than that of ^{232}Th . Gamma spectral analysis of the samples collected from the four sample grids consistently indicates the presence of natural uranium and thorium isotopes in secular equilibrium. This suggests that neither uranium nor thorium tailings are present at the locations sampled.

It is notable that the soil sample collected from the ground surface (0 to 1 foot depth increment) in Grid FS-01, node H-14 (SS540001XX) appears to have slightly elevated concentrations of natural thorium activity in secular equilibrium (indicating natural occurrence). The sample was collected at the location within the grid with the highest recorded static gamma count rate measurement, 174 cps. The gamma radiation fluence from ^{232}Th readily accounts for the ground surface gamma count rate measurement in this grid. It is also notable that the soil sample collected from the 1 to 2 foot bgs depth increment at this same location (SS540101XX) has ^{232}Th decay series activity in concentrations consistent with background.

Samples collected at node I-4 in Grid I-S95, (SS560001XX and SS560101XX) indicate the presence of slightly elevated concentrations of natural uranium series isotopes. The concentrations of uranium series radionuclides in these samples are approximately 5 to 7 pCi/g. These were again collected at the location within the grid with the highest recorded static gamma count rate measurement, 186 cps. Given that the uranium isotopes are in equilibrium, and that the sample was collected from the location having the highest gamma count rate within the grid, these concentrations are not significant as radiological hazards. The gamma radiation fluence from ^{226}Ra readily accounts for the ground surface gamma count rate measurement in this grid.

The location with the highest gamma count rate measurement (and surface scan measurement) in Grid FS-07 was located at node N-16 (217cps) illustrated in Figure 4. Samples collected at this location (SS580001XX and SS580101XX, and their duplicates) again indicate the presence of natural uranium with its isotopes in equilibrium. This sample is unique among those collected in that it indicates concentrations of ^{238}U and its progeny ranging between 12 and 16 pCi/g. This activity is higher than average concentrations of natural radioactivity found in typical background soils. However, this activity is apparently limited to a relatively small area as indicated by the localized presence of the corresponding elevated gamma count rate.

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Samples collected from within Grid 1-S92 (SS580001XX and SS580101XX), illustrated on Figure 5, indicate no isotopes that are either elevated in comparison with concentrations expected in natural background in soils or in disequilibrium with the parent uranium or thorium isotopes. In short, no evidence was uncovered in the gamma spectroscopy analysis that would suggest the presence of elevated radioactivity. This is consistent with the fact gross gamma count rate measurements in the grid also indicated no elevated readings.

5.3.2 Alpha Spectroscopy Results

The alpha spectroscopy analyses yielded unexpected results, as they are inconsistent with the gamma spectroscopy results, while being internally consistent. For example, uranium alpha spectroscopy results for soil sample SS560001XX (Table 5-2, below) report ^{238}U activity at 0.67 pCi/g, with its progeny ^{234}U essentially in equilibrium (within the accuracy of the analysis) at 0.53 pCi/g. That they are in equilibrium suggests that the uranium activity in the sample is naturally occurring (not depleted uranium or tailings), a finding consistent with that arrived at from interpretation of the gamma spectroscopy measurement of the same soil sample. The ^{235}U activity via alpha spectroscopy is reported to be 0.044 pCi/g. When compared with the ^{238}U alpha spectroscopy activity results, ^{235}U activity is present in proportion approximately consistent with that expected in natural uranium. However, the reported ^{238}U (and ^{234}U) activity via alpha spectroscopy is significantly less than that reported for ^{238}U (and its progeny) by gamma spectroscopy analysis. This discrepancy between alpha spectroscopy and gamma spectroscopy results is apparent in most of the samples analyzed. Harding ESE consulted with the analytical laboratory that performed the analyses to discuss the apparent discrepancy. After reviewing the quality assessment and control for the analyses, it was determined that the gamma spectroscopy results were valid, internally consistent, and consistent with activity concentrations expected in soil samples collected in locations with elevated gross gamma count rate readings on the ground surface.

Table 5-2. Results from Soil Sample SS560001XX

Isotope (Uranium Decay Series)	Results by Analytical Method (Units: pCi/g)	
	Gamma Spectroscopy (300 MOD)	Alpha Spectroscopy (3004/RP-725)
Uranium 238	6.2	0.67
Thorium 234	6.77	Note 1
Protactinium 234M	10.9	Note 1
Uranium 234	Note 2	0.53
Thorium 230	Note 2	0.8
Radium 226	6.93	NA
Lead 214	7.28	Note 1
Bismuth 214	6.92	Note 1
Lead 210	4.05	Note 1
Uranium 235		0.044
NA: Not analyzed by this method.		
Note 1: Does not decay by alpha emission.		
Note 2: Decay of isotope produces no usable gamma signal.		

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Alpha spectroscopy analysis provides a much greater opportunity for analytical error for a host of reasons. Only a small fraction of the total soil sample submitted (a 1 to 2 gram aliquot) is used to perform the analysis. This introduces the possibility of variability due to a lack of homogeneity in the bulk sample. Harding ESE believes that this potential source of error was adequately controlled because: 1) the samples were sieved and blended in the field prior to packaging in sample containers, and 2) the analytical laboratory, following gamma spectroscopy analysis, dried, ground, and blended the entire sample before selecting an aliquot for alpha spectroscopy analysis. A second potential source of error, and in the opinion of the analytical chemists at the contract laboratory the most likely source, derives from the ability of the chemical digestion process to completely render the species of concern (e.g., uranium) in a chemical form that can be readily extracted from solution. It is possible that the chemicals and processes used in the laboratory to digest the soil particle matrix and break uranium chemical bonds were ineffective at completely digesting the sample or a portion of it. A third potential source of error is the possibility that the ion exchange process used to extract the species of concern (e.g., uranium) was inefficient at adsorbing the particular oxidation state of the uranium species. This is not thought to be a likely circumstance as the ion exchange media used is designed specifically for the chemical species of concern, and because the digestion process (when effective) renders the elemental species in chemical forms readily adsorbed.

At the request of Harding ESE, the laboratory reprocessed selected soil samples (including ones from location SS58) using more aggressive digestion and extraction techniques than are typically used in an attempt to discern whether an inadequate digestion or extraction might be responsible for the discrepancy. These samples produced results consistent with the previous alpha spectroscopy results, leaving the alpha spectroscopy results uncertain. Harding ESE and the Corps have not used the alpha spec results to draw conclusions in this report about the radiological conditions in the survey grids considered.

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6 CONCLUSIONS

Both uranium and thorium tailings produce a clear and evident gamma radiation signal (from ^{226}Ra and ^{228}Ra , respectively). If tailings were present on site in even relatively small volumes, they would produce a readily discernable elevated or anomalous gamma radiation signal. Previous site-wide gamma scans performed by MK (Harding ESE, 2000) identified no significant gamma anomalies. Similarly, gamma scanning of the four survey areas sampled in this focused tailings investigation identified only minor gamma anomalies, which the gamma spectroscopy analysis of soil from these locations showed to be attributable to naturally occurring radioactivity and not indicative of tailings.

6.1 GRID 1-S92

None of the three types of gamma radiation measurements (general area, static gamma count rate measurements, and gamma scanning of the ground surface) performed in Grid 1-S92 gave indication of the presence of elevated or anomalous gamma radiation levels, suggesting that tailings are not present. Soil sample data from Grid 1-S92 corroborate the findings suggested by the gamma measurements, again showing that tailings are not present and that radionuclides present in the soil sampled are consistent with that expected in background soils having naturally occurring radioactivity. Harding ESE concludes that no further sampling or investigation relative to the constituency of radioactive isotopes is warranted or necessary in this grid.

6.2 GRIDS FS-01, FS-07, AND 1-S95

In grids FS-01, FS-07, and 1-S95, gamma radiation measurements point to a slightly elevated gamma fluence. Soil samples, biased to collect samples from locations yielding the highest gamma radiation signals, indicate the presence of slightly elevated concentrations of natural radioactivity in soil. The sample results show that it is not credible to consider that tailings of uranium or thorium ores might be responsible for the localized gamma radiation signals detected in these grids. The explanation for the slightly elevated gamma signals detected is the presence of slightly elevated concentrations of natural radioactivity in soils.

6.3 SUMMARY

Given the history of the site, and the fact that this portion of the site was filled to achieve the current grade (Harding ESE, 2000), it seems reasonable to conclude that the elevated concentrations of natural radioactivity in soils are associated with the fill material. The elevated natural radioactivity is associated with the small particle size fraction as evidenced by the fact that: 1) the soil samples were sieved in the field to remove large particle size fractions, 2) the large fraction was consistently found to have little or no measurable radioactivity, and 3) the small size fraction was found to have radioactivity concentrations corollary to the gamma ground surface measurements. These circumstances point to the possibility that naturally occurring radioactivity in coal ash known to be a constituent of the fill materials used (Harding ESE, 2001a) at the site may be responsible for the radioactivity measured.

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Whatever the source, it is clear that the radioactivity in the soil sampled in the four grids is naturally occurring and that tailings are not responsible for the anomalies previously reported on by MK and ANL (ANL, 1983 and MK, 1996).

Soil sampling was biased to ensure that samples were collected from the locations that were likely to have the highest radioactivity in soil. This suggests that the soil samples collected provide a reasonable estimate of the upper bound of natural radioactivity in soil in the backfilled area of Property 20. Harding ESE recommends that all existing ^{226}Ra data from this area be considered in conjunction with this new data to determine whether additional data is necessary to demonstrate compliance with the soil DCGL. Should data gaps be found, additional, statistically-based sampling should be completed to address those data gaps.

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REFERENCES

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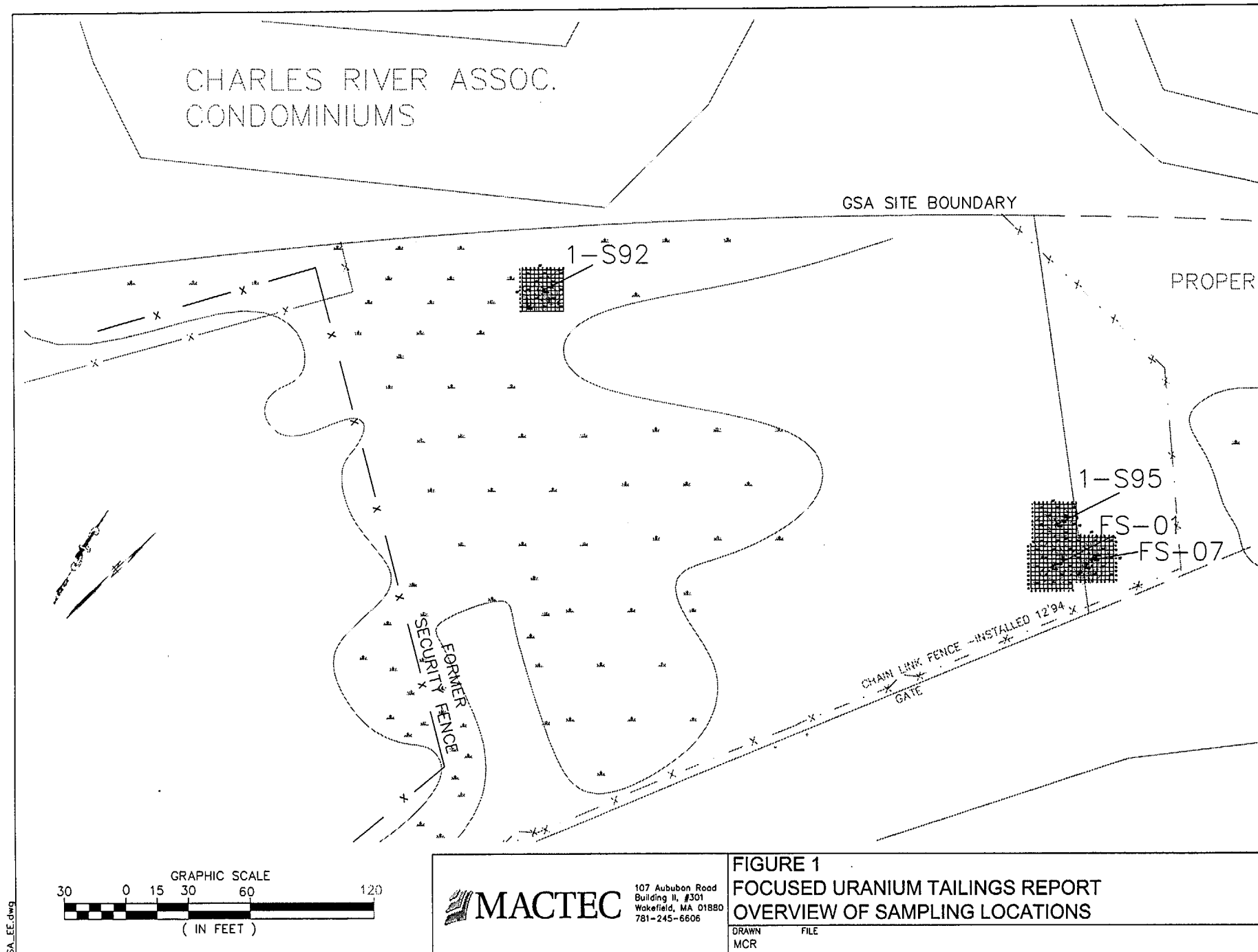
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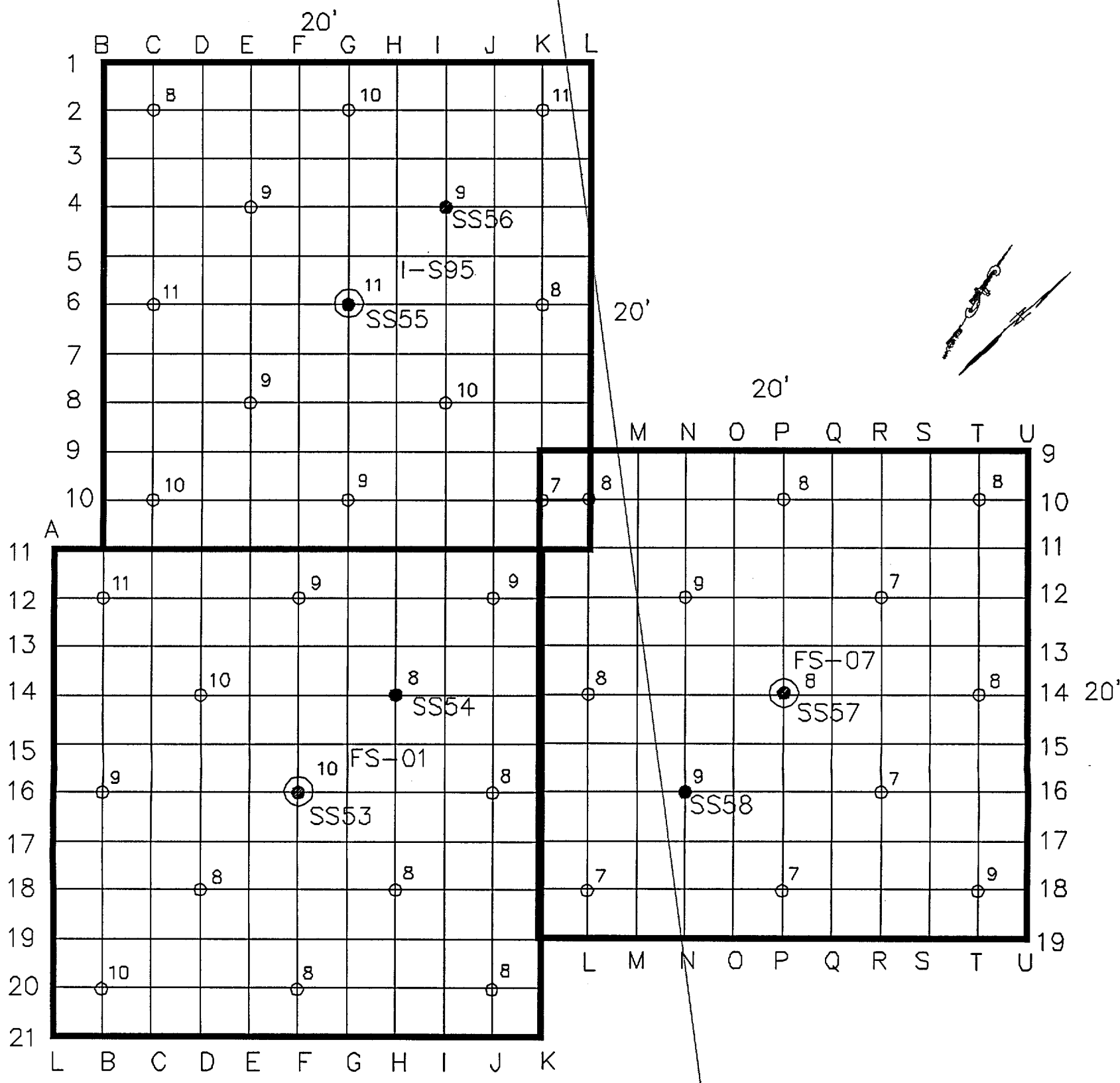
ACRONYMS

AE	architect/engineer
AEC	Atomic Energy Commission
ANL	Argonne National Laboratories
bgs	below ground surface
CENAE	U.S. Army Corps of Engineers, New England District
cpm	counts per minute
cps	counts per second
CSA	Comprehensive Site Assessment
DCGL	Derived Concentration Guideline Level
DERP	Defense Environmental Restoration Program
DOE	Department of Energy
FUSRAP	Formerly Utilized Sites Remedial Action Program
GPS	Global Positioning System
GSA	General Services Administration
HSA	Historical Site Assessment
MADEP	Massachusetts Department of Environmental Protection
MADPH	Massachusetts Department of Public Health
MCP	Massachusetts Contingency Plan
MDC	Metropolitan District Commission
MIT	Massachusetts Institute of Technology
MK	Morrison-Knudsen Inc.
NaI	sodium iodide
NRC	United States Nuclear Regulatory Commission
PA	Preliminary Assessment
pCi/g	picocuries per gram
PPE	personal protective equipment
QA/QC	quality assurance and quality control
²²⁶ Ra	radium-226
²³⁴ Th	thorium-234
UCL	upper confidence limit
²³⁵ U	uranium 235
²³⁸ U	uranium-238
μR/hr	microrem/hour

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FIGURES

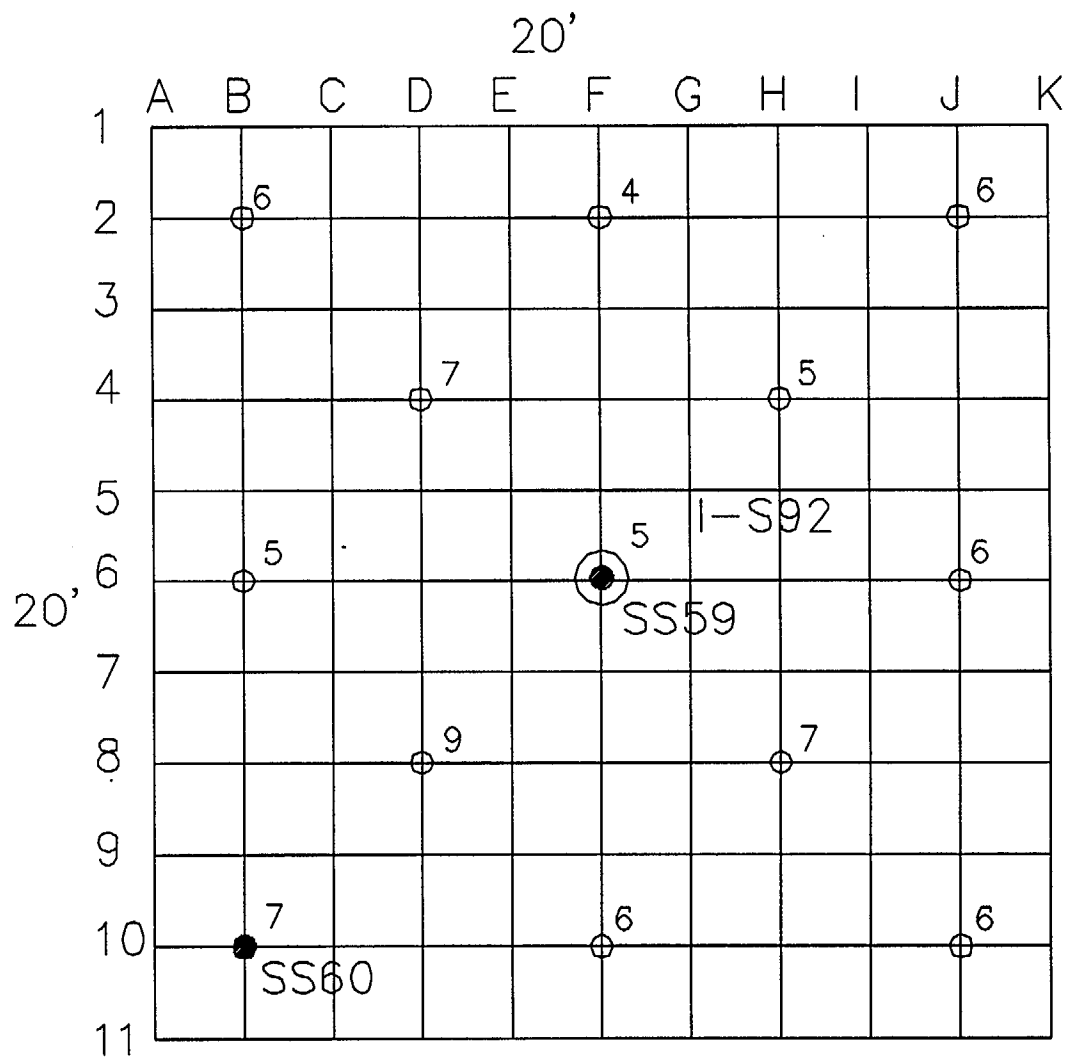
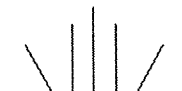




○ LOCATIONS OF WAIST HIGH
GAMMA EXPOSURE
MEASUREMENTS USING
BICRON MICROREM (uR/hr)

Harding ESE
107 Adams Road
Andover, MA 01810
781-245-0000

FIGURE 2
BICRON MEASUREMENTS
1-S95, FS-01 AND FS-07



1" = 4'

○ LOCATIONS OF GAMMA EXPOSURE
MEASUREMENTS USING BICRON MICROREM
(uR/hr)

● SOIL SAMPLE LOCATION

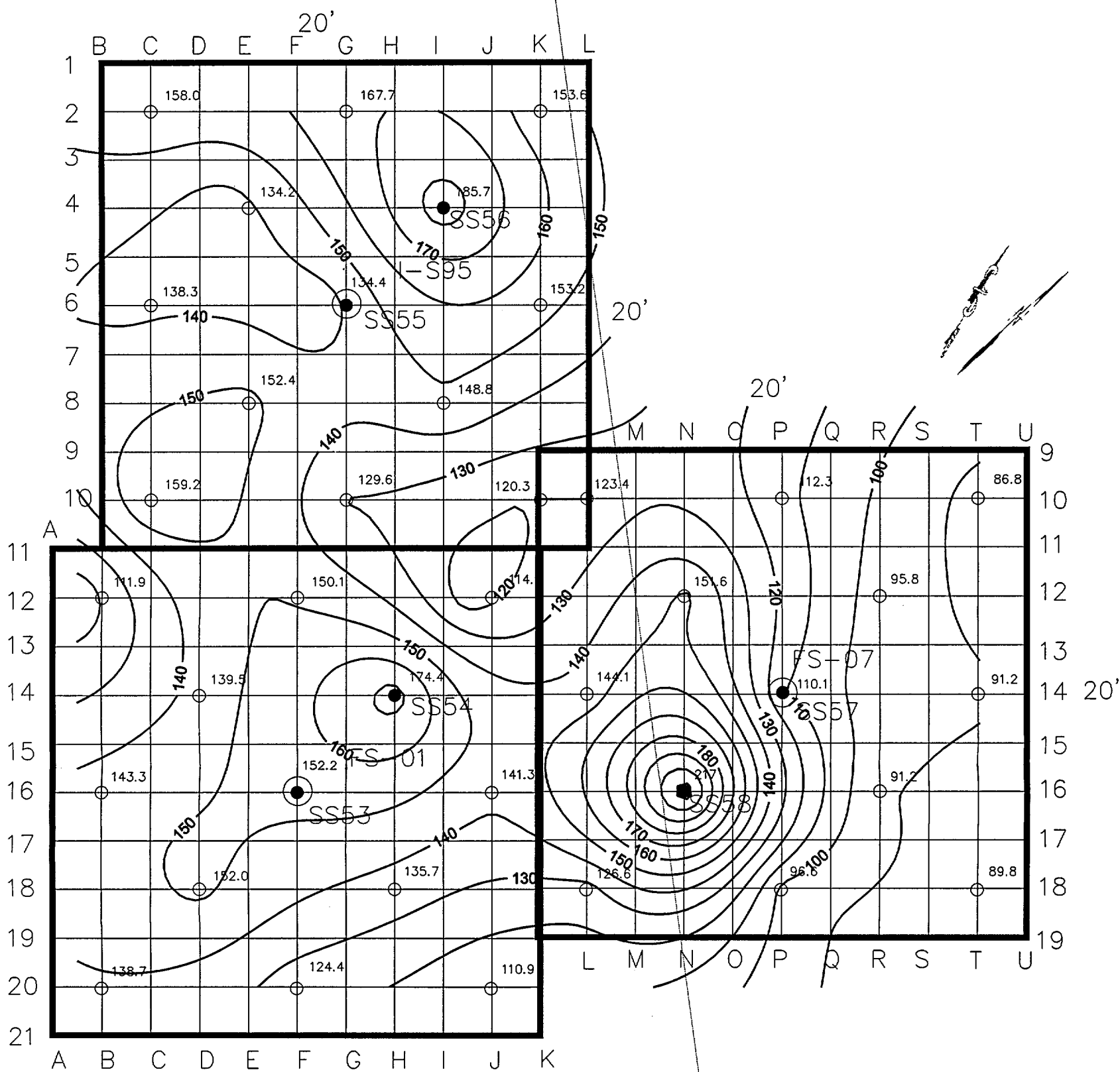


Harding BSE
A MACOM Company

107 Ashton Road
Burlington, MA 01803
781-245-8408

FIGURE 3
BICRON MEASUREMENTS

DRAWN BY
MCR



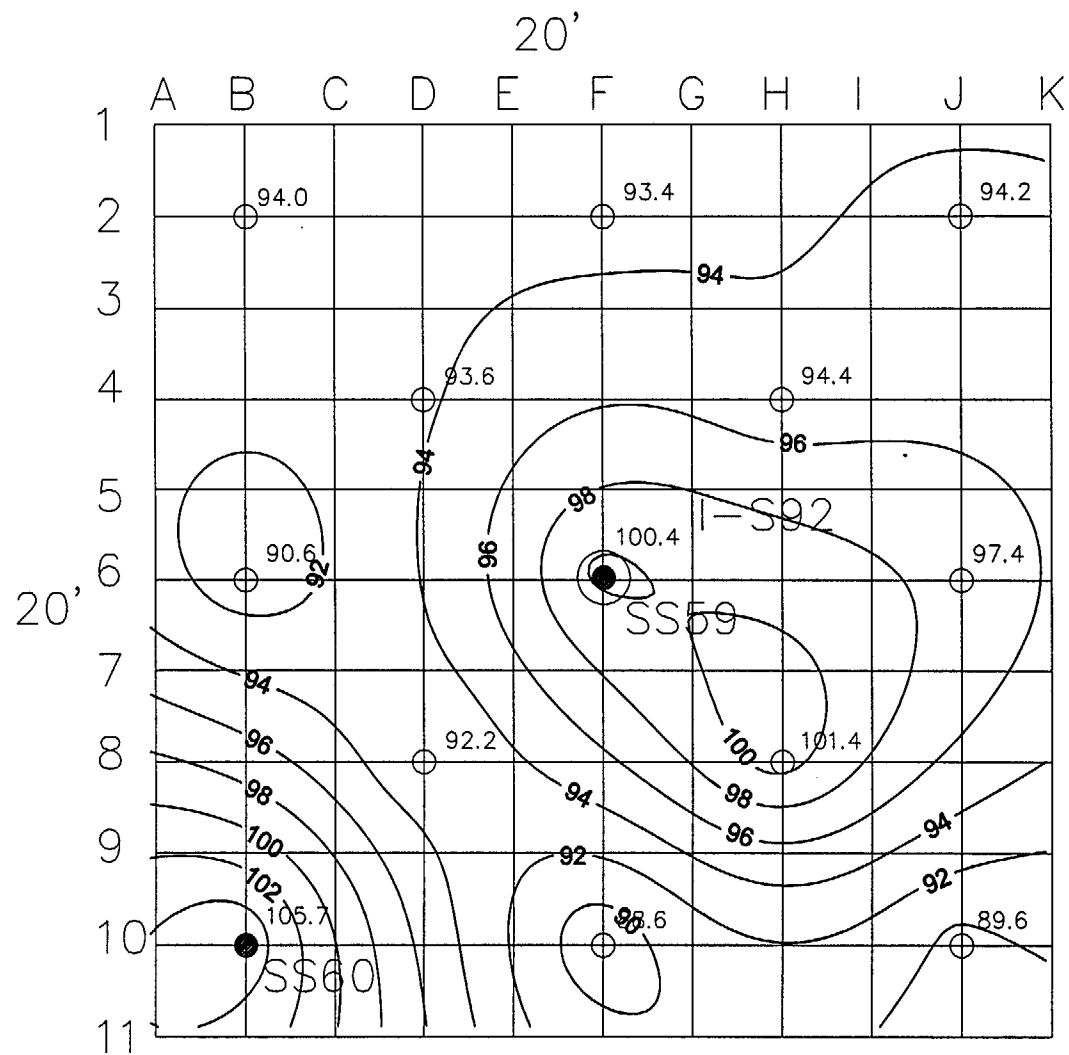
105.7 GAMMA MEASUREMENT
(COUNTS PER SECOND)

○ LOCATIONS OF INITIAL STATIC
MEASUREMENTS TO
DETERMINE THE MEAN AND
95% UCL FOR THE SURVEY
AREA

● SOIL SAMPLE LOCATIONS

MACTEC 107 Auburn Road
Building N, 2001
Worcester, MA 01800
781-245-8506

FIGURE 4
FOCUSED URANIUM TAILINGS REPORT
CONTACT GAMMA MEASUREMENTS
USING 1.5" X 1.5" NaI DETECTOR (CPS)
1-S95, FS-01 AND FS-07



1" = 4'

105.7 GAMMA MEASUREMENT (COUNTS PER SECOND)

○ LOCATIONS OF INITIAL STATIC MEASUREMENTS TO DETERMINE THE MEAN AND 95% UCL FOR THE SURVEY AREA

● SOIL SAMPLE LOCATION

MACTEC

107 Auburn Road
Building # 8301
Worcester, MA 01880
781-245-6606

FIGURE 5
FOCUSED URANIUM TAILINGS REPORT
CONTACT MEASUREMENTS WITH 1.5" X 1.5" NaI DETECTOR

DRAWN
MCR

FILE

APPENDIX A
FIELD DATA SHEETS

9/5/2002

RADIOLOGICAL SURVEY REMARKS

Survey Number: _____

Page _____ of _____

Remarks:

1015 - MET FLEET ENVIRONMENTAL CREW @ GSA SITE,
CONDUCTED SITE BRIEFING AND DISCUSSED THE
RADIOLOGICAL CONDITIONS & POTENTIAL HAZARDS AT
THE SITE. DISCUSSED THE CONDITIONS FOR WORK
IN THE WETLANDS BUFFER AREA (NO FUELING
IN BUFFER AREA, TREES > 3" @ 1 meter above ground
MUST STAY IN PLACE).

RUSO BOB ARRUDA Bob Arruda
JOE BRUCE Joe Bruce
DENNIS GROW Dennis Grow
JASON VAUGHN Jason Vaughn

Form RPO-301-1-3

PROCEDURE NO: RPO-301

REVISION NO: 1

ATTACHMENT 3
PAGE NO: 1 OF 1

RADIOLOGICAL SURVEY FORM

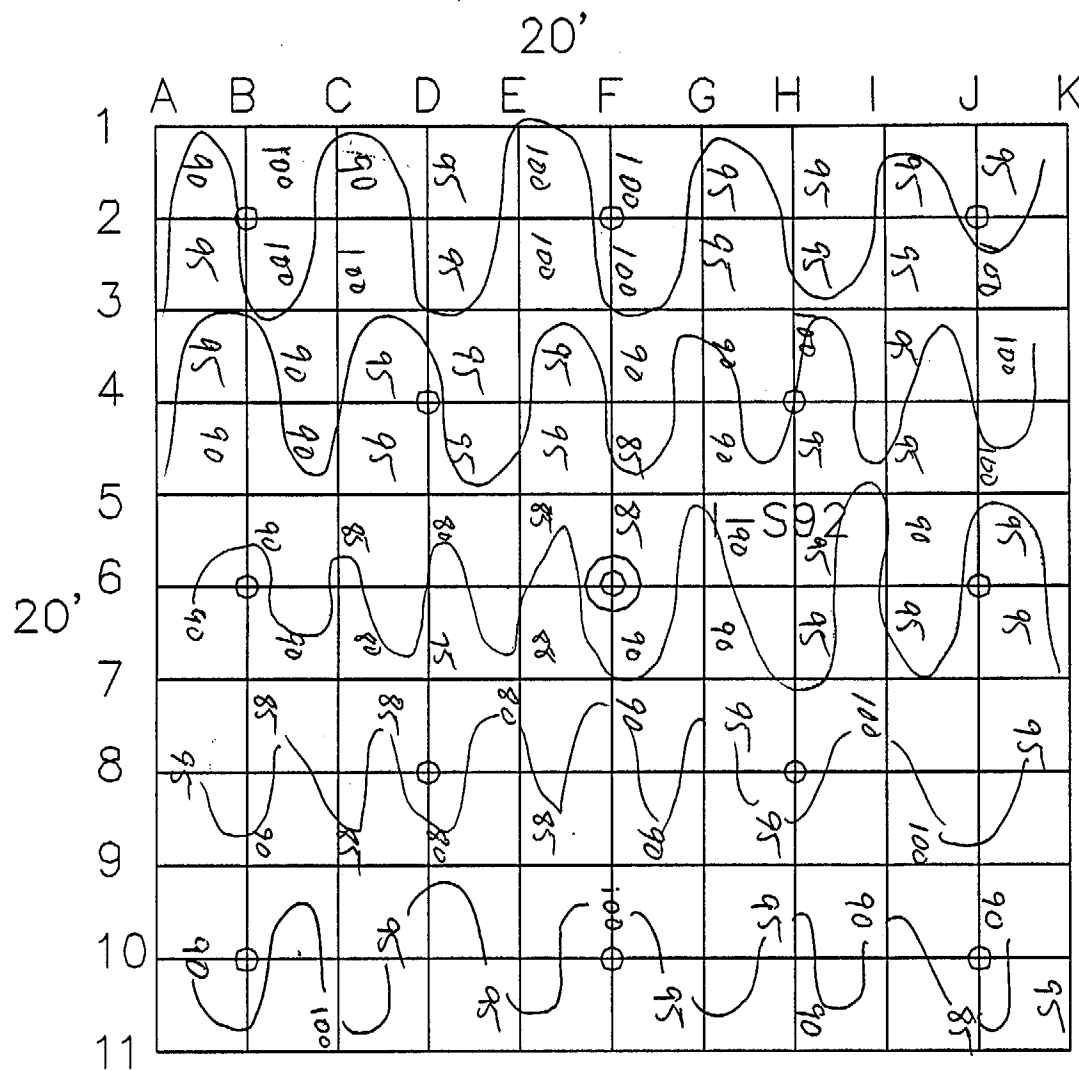
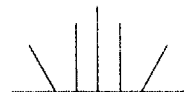
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Page 1 of 1[illegible]

PROCEDURE NO: RP0-301

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ATTACHMENT 1
PAGE NO: 1 OF 1



1" = 4'

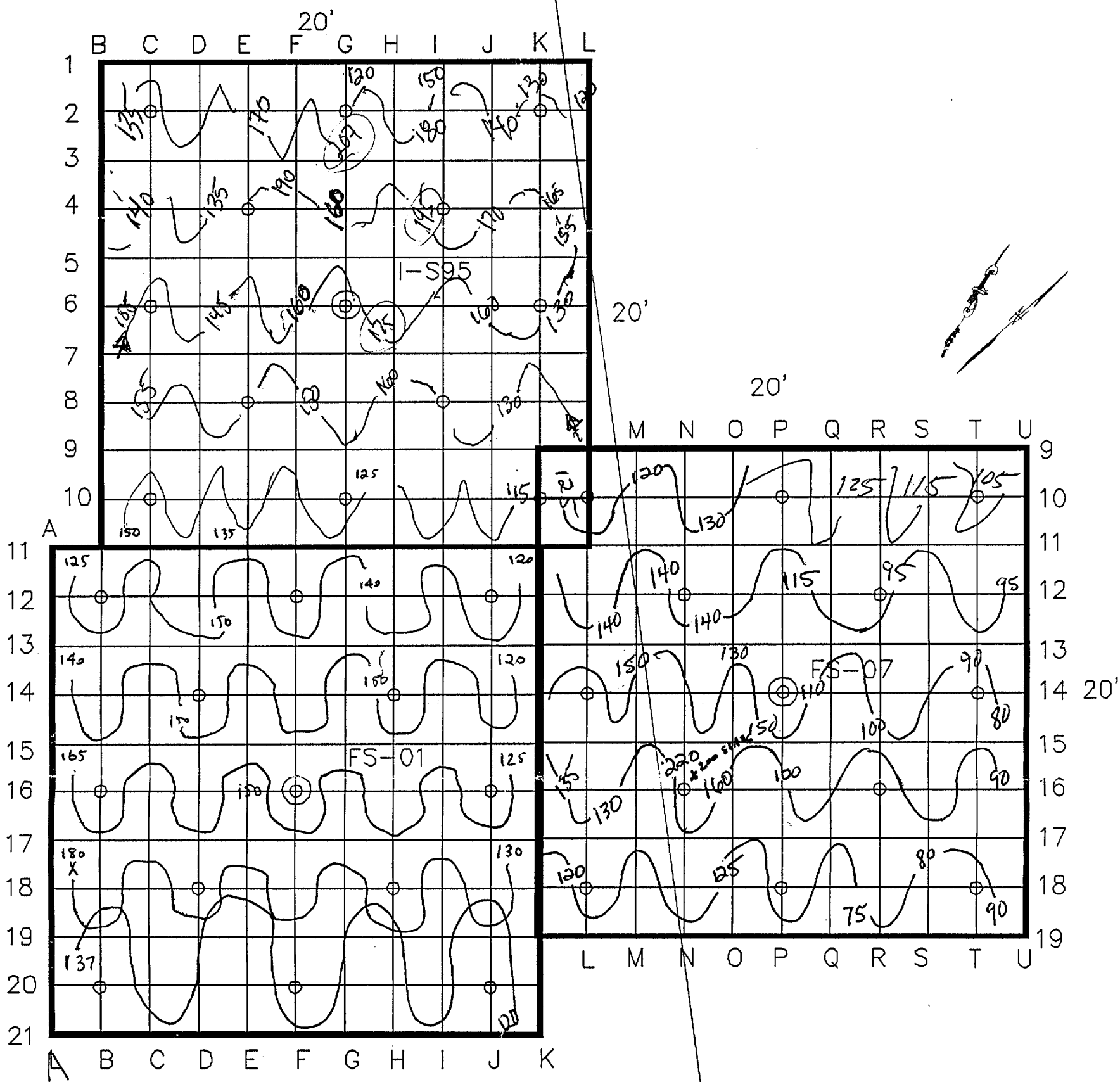
○ LOCATIONS OF INITIAL STATIC MEASUREMENTS TO DETERMINE THE MEAN AND 95% UCL FOR THE SURVEY AREA



107 Ashbury Road
Bedford, MA 01830
781-863-0010

FIGURE 2-3
SAMPLE LOCATION 1-S92

DATE: FILE:
MCR



○ LOCATIONS OF INITIAL STATIC MEASUREMENTS TO DETERMINE THE MEAN AND 95% UCL FOR THE SURVEY AREA
1" = 5'

Harding ESE
A MARYLAND COMPANY
107 Ardmore Road
Bel Air, MD 21054
410-340-8800

FIGURE 2-4
SAMPLE LOCATIONS
1-S95, FS-01 AND FS-07

APPENDIX B

LABORATORY DATA SHEETS

**Focused Tailings Investigation
Laboratory Data Summary**

SampleID			SS530001XX	SS530001XX DUP	SS540001XX	SS540101XX	SS550001XX	SS560001XX	SS560101XL
Date Sampled			9/11/2002	9/11/2002	9/11/2002	9/11/2002	9/11/2002	9/11/2002	9/11/2002
Percent Moisture			9.4	--	9.2	9.1	9.9	9.2	5.4
Analytical Method									
300 MOD	Actinium 227	pCi/g							
300 MOD	Actinium 228	pCi/g	1.28 ± 0.37	1.19 ± 0.36	4.4 ± 1.2	2.41 ± 0.65	0.65 ± 0.22	1.82 ± 0.54	
300 MOD	Bismuth 212	pCi/g		1.31 ± 0.47	4.96 ± 0.78		0.89 ± 0.35		
300 MOD	Bismuth 214	pCi/g	3.99 ± 0.48	4.03 ± 0.51	1.09 ± 0.15	0.98 ± 0.14	2.77 ± 0.36	6.92 ± 0.86	3.77 ± 0.65
300 MOD	Cesium 137	pCi/g	0.05 ± 0.17	0.048 ± 0.017		0.285 ± 0.055	0.061 ± 0.017	0.06 ± 0.021	
300 MOD	Lead 210	pCi/g	3.34 ± 0.72	2.99 ± 0.84		1.05 ± 0.68	2.04 ± 0.56	4.05 ± 0.88	
300 MOD	Lead 212	pCi/g	1.2 ± 0.16	1.17 ± 0.15	4.18 ± 0.52	2.08 ± 0.26	0.707 ± 0.096	1.37 ± 0.18	0.81 ± 0.18
300 MOD	Lead 214	pCi/g	4.28 ± 0.51	4.09 ± 0.50	1.04 ± 0.14	1.11 ± 0.15	2.91 ± 0.36	7.28 ± 0.87	3.92 ± 0.67
300 MOD	Potassium 40	pCi/g	2.07 ± 0.57	2.02 ± 0.56		5.04 ± 0.76	1.26 ± 0.42	1.28 ± 0.65	
300 MOD	Protactinium 234M	pCi/g	4.8 ± 3.8	6.5 ± 3.8			6.8 ± 3.0	10.9 ± 7.0	
300 MOD	Radium 226	pCi/g	4.3 ± 0.52	4.17 ± 0.52	1 ± 0.16	1 ± 0.14	2.89 ± 0.37	6.93 ± 0.81	4.04 ± 0.77
300 MOD	Radium 223	pCi/g			0.52 ± 0.29				
300 MOD	Radium 228	pCi/g	0.99 ± 0.19	0.88 ± 0.21	3.66 ± 0.46	1.59 ± 0.25	0.77 ± 0.19	1.29 ± 0.28	0.68 ± 0.48 U
300 MOD	Thallium 208	pCi/g	0.97 ± 0.25	1.1 ± 0.28	3.89 ± 0.90	1.75 ± 0.43	0.63 ± 0.18	1.09 ± 0.30	0.97 ± 0.40
300 MOD	Thorium 231	pCi/g	1.01 ± 0.21	1.62 ± 0.35	1.24 ± 0.23	0.77 ± 0.18		1.42 ± 0.27	
300 MOD	Thorium 232	pCi/g	0.98 ± 0.19	0.88 ± 0.20	3.64 ± 0.46	1.58 ± 0.25	0.76 ± 0.19	1.28 ± 0.28	0.68 ± 0.48
300 MOD	Thorium 234	pCi/g	4.41 ± 0.63	2.68 ± 0.41	4.01 ± 0.70	2.54 ± 0.39	2.75 ± 0.41	6.77 ± 0.94	3.8 ± 1.7
300 MOD	Uranium 235	pCi/g							
300 MOD	Uranium 238	pCi/g	3.63 ± 0.70	3.65 ± 0.83	2.18 ± 0.95	1.23 ± 0.60	3.4 ± 1.1	6.2 ± 1.1	4 ± 2.6
3004/RP-725	Thorium 228	pCi/g	0.64 ± 0.14	0.64 ± 0.14	6.4 ± 1.2	2.79 ± 0.55	0.375 ± 0.087	0.56 ± 0.14	0.56 ± 0.13
3004/RP-725	Thorium 230	pCi/g	0.72 ± 0.15	0.69 ± 0.15	1.66 ± 0.33	1.21 ± 0.25	0.46 ± 0.10	0.8 ± 0.18	0.7 ± 0.15
3004/RP-725	Thorium 232	pCi/g	0.61 ± 0.13	0.64 ± 0.14	6 ± 1.1	2.68 ± 0.53	0.352 ± 0.082	0.47 ± 0.12	0.46 ± 0.11
3050/RP-725	Uranium 234	pCi/g	0.43 ± 0.11	0.52 ± 0.12	1.39 ± 0.28	0.91 ± 0.20	0.347 ± 0.083	0.53 ± 0.12	0.71 ± 0.16
3050/RP-725	Uranium 235	pCi/g	0.059 ± 0.030 J	0.03 ± 0.022 J	0.096 ± 0.037 J	0.08 ± 0.041 J	0.016 ± 0.015 U	0.044 ± 0.024 J	0.056 ± 0.028 J
3050/RP-725	Uranium 238	pCi/g	0.74 ± 0.16	0.87 ± 0.18	2.12 ± 0.42	1.14 ± 0.25	0.351 ± 0.084	0.67 ± 0.15	0.88 ± 0.19
Lead	Lead								

**Focused Tailings Investigation
Laboratory Data Summary**

	SampleID		SS560101XL DUP	SS560101XX	SS570001XX	SS580001XD	SS580001XX	SS580101XD	SS580101XX
	Date Sampled		9/11/2002	9/11/2002	9/11/2002	9/11/2002	9/11/2002	9/11/2002	9/11/2002
Analytical Method	Percent Moisture		--	7.0	8.6	8.9	9.0	8.1	8.4
300 MOD	Actinium 227	pCi/g				0.58 ± 0.15		0.85 ± 0.17	0.8 ± 0.18
300 MOD	Actinium 228	pCi/g		1.37 ± 0.41	1.06 ± 0.32	3.16 ± 0.85	3.3 ± 0.91	4 ± 1.1	4 ± 1.1
300 MOD	Bismuth 212	pCi/g				3.74 ± 0.97		4 ± 1.1	
300 MOD	Bismuth 214	pCi/g	3.98 ± 0.69	5.07 ± 0.65	2.57 ± 0.34	14.5 ± 1.7	13.8 ± 1.7	16 ± 2.0	16.7 ± 2.0
300 MOD	Cesium 137	pCi/g			0.12 ± 0.22	0.101 ± 0.028	0.078 ± 0.026		
300 MOD	Lead 210	pCi/g		3.73 ± 0.73	2.54 ± 0.77	7.8 ± 1.3	7.3 ± 1.4	6.1 ± 1.2	7 ± 1.5
300 MOD	Lead 212	pCi/g	0.76 ± 0.18	1.22 ± 0.16	0.97 ± 0.13	3.28 ± 0.41	3.11 ± 0.38	3.33 ± 0.41	3.53 ± 0.44
300 MOD	Lead 214	pCi/g	4.38 ± 0.66	5.37 ± 0.64	2.68 ± 0.33	14.7 ± 1.7	14.4 ± 1.7	16.7 ± 2.0	17.4 ± 2.1
300 MOD	Potassium 40	pCi/g		0.57 ± 0.55	6.55 ± 0.96	2.54 ± 0.88	2.7 ± 0.84	2.16 ± 0.80	1.84 ± 0.90
300 MOD	Protactinium 234M	pCi/g				16.8 ± 7.9	12.2 ± 7.9	20.5 ± 7.4	13.5 ± 9.3
300 MOD	Radium 226	pCi/g	4.07 ± 0.72	5.37 ± 0.62	2.83 ± 0.36	14.6 ± 1.7	13.9 ± 1.6	16.9 ± 2.0	16.5 ± 1.9
300 MOD	Radium 223	pCi/g		0.62 ± 0.34		0.83 ± 0.74	1.07 ± 0.76	1.37 ± 0.77	1.99 ± 0.95
300 MOD	Radium 228	pCi/g	0.96 ± 0.59	1.14 ± 0.25	0.9 ± 0.20	2.83 ± 0.44	2.6 ± 0.50	2.66 ± 0.48	2.9 ± 0.51
300 MOD	Thallium 208	pCi/g	0.78 ± 0.40	1.06 ± 0.28	0.82 ± 0.22	2.82 ± 0.66	2.6 ± 0.63	3.16 ± 0.74	3.43 ± 0.86
300 MOD	Thorium 231	pCi/g		1.18 ± 0.25	0.59 ± 0.17	3.14 ± 0.50	4.33 ± 0.69	1.13 ± 0.19	1.91 ± 0.30
300 MOD	Thorium 232	pCi/g	0.96 ± 0.59	1.14 ± 0.25	0.89 ± 0.20	2.82 ± 0.44	2.59 ± 0.50	2.65 ± 0.48	2.89 ± 0.51
300 MOD	Thorium 234	pCi/g	2.45 ± 0.88	5.69 ± 0.80	2.98 ± 0.47	13.8 ± 1.9	15.4 ± 2.1	12 ± 1.6	12.6 ± 1.7
300 MOD	Uranium 235	pCi/g				0.96 ± 0.49	0.74 ± 0.34	0.93 ± 0.38	0.73 ± 0.36
300 MOD	Uranium 238	pCi/g	2.6 ± 1.7	5.1 ± 1.2	2.99 ± 0.63	12.4 ± 1.9	13.4 ± 2.2	11.9 ± 2.0	13.6 ± 2.1
3004/RP-725	Thorium 228	pCi/g		0.69 ± 0.15	0.84 ± 0.18	0.92 ± 0.20	1.12 ± 0.24	0.79 ± 0.17	0.86 ± 0.19
3004/RP-725	Thorium 230	pCi/g		0.74 ± 0.16	0.72 ± 0.16	0.85 ± 0.18	1.1 ± 0.24	0.75 ± 0.16	0.99 ± 0.21
3004/RP-725	Thorium 232	pCi/g		0.65 ± 0.14	0.82 ± 0.18	0.9 ± 0.19	0.94 ± 0.21	0.69 ± 0.15	0.87 ± 0.19
3050/RP-725	Uranium 234	pCi/g		0.55 ± 0.12	0.65 ± 0.14	0.82 ± 0.18	0.98 ± 0.21	0.61 ± 0.14	0.81 ± 0.17
3050/RP-725	Uranium 235	pCi/g		0.041 ± 0.025 J	0.043 ± 0.026 J	0.08 ± 0.034 J	0.067 ± 0.036 J	0.038 ± 0.027 J	0.071 ± 0.031 J
3050/RP-725	Uranium 238	pCi/g		0.66 ± 0.15	1.12 ± 0.23	1.64 ± 0.33	1.64 ± 0.34	1.14 ± 0.24	1.26 ± 0.26
Lead	Lead								

**Focused Tailings Investigation
Laboratory Data Summary**

	SampleID	SS590001XX	SS590101XX	SS600001XX
	Date Sampled	9/11/2002	9/11/2002	9/11/2002
Analytical Method	Percent Moisture	17.1	17.8	11.6
300 MOD	Actinium 227	pCi/g		
300 MOD	Actinium 228	pCi/g	0.69 ± 0.22	1.03 ± 0.31
300 MOD	Bismuth 212	pCi/g		
300 MOD	Bismuth 214	pCi/g	0.64 ± 0.11	1.43 ± 0.19
300 MOD	Cesium 137	pCi/g	0.054 ± 0.026	0.217 ± 0.037
300 MOD	Lead 210	pCi/g	1.15 ± 0.44	2.31 ± 0.64
300 MOD	Lead 212	pCi/g	0.643 ± 0.087	0.95 ± 0.13
300 MOD	Lead 214	pCi/g	0.604 ± 0.099	1.56 ± 0.20
300 MOD	Potassium 40	pCi/g	13.7 ± 1.7	11.1 ± 1.4
300 MOD	Protactinium 234M	pCi/g		
300 MOD	Radium 226	pCi/g	0.593 ± 0.092	1.56 ± 0.22
300 MOD	Radium 223	pCi/g		
300 MOD	Radium 228	pCi/g	0.67 ± 0.16	0.77 ± 0.18
300 MOD	Thallium 208	pCi/g	0.59 ± 0.17	0.82 ± 0.21
300 MOD	Thorium 231	pCi/g		
300 MOD	Thorium 232	pCi/g	0.67 ± 0.16	0.77 ± 0.18
300 MOD	Thorium 234	pCi/g	1.16 ± 0.22	3.18 ± 0.48
300 MOD	Uranium 235	pCi/g		
300 MOD	Uranium 238	pCi/g	0.49 ± 0.50	2.73 ± 0.62
3004/RP-725	Thorium 228	pCi/g	0.97 ± 0.21	0.93 ± 0.20
3004/RP-725	Thorium 230	pCi/g	0.99 ± 0.21	0.79 ± 0.18
3004/RP-725	Thorium 232	pCi/g	0.99 ± 0.21	0.75 ± 0.17
3050/RP-725	Uranium 234	pCi/g	0.86 ± 0.20	1 ± 0.22
3050/RP-725	Uranium 235	pCi/g	0.023 ± 0.025 U	0.115 ± 0.049
3050/RP-725	Uranium 238	pCi/g	1.03 ± 0.23	2.54 ± 0.52
Lead	Lead			

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ANALYTICAL REPORT


Boston Army Arsenal

Lot #: F2I130297

Mark Salvetti

Harding ESE
107 Audubon Road
Bldg 2 Suite 301
Wakefield, MA 01880

SEVERN TRENT LABORATORIES, INC.


Billy Tierney
Project Manager

October 30, 2002

STL St. Louis is a part of Severn Trent Laboratories, Inc.

Case Narrative
LOT NUMBER: F2I130297

This report contains the analytical results for the 19 samples received under chain of custody by STL St. Louis on September 13, 2002. These samples are associated with your Boston Army Arsenal project.

All applicable quality control procedures met method-specified acceptance criteria except as noted on the following page.

This report is incomplete without the case narrative. All results are based upon sample as received, wet weight, unless noted otherwise.

Observations/Nonconformances

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

There are no conformance issues associated with the analysis of these samples.

METHODS SUMMARY

F2I130297

<u>PARAMETER</u>	<u>ANALYTICAL METHOD</u>	<u>PREPARATION METHOD</u>
Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 3010A
Isotopic TH by Alpha Spec Alpha Spectroscopy	NAS/DOE 3004/RP	
Isotopic U by Alpha Spec Alpha Spectroscopy	NAS/DOE 3050/RP	
Percent Moisture	MCAWW 160.3 MOD	MCAWW 160.3 MOD
Ra-226 and Hits by Gamma GAMMA SPEC MULTI ISO CAL	HASL 300 MOD	

References:

HASL Health and Safety Laboratory

MCAWW "Methods for Chemical Analysis of Water and Wastes",
EPA-600/4-79-020, March 1983 and subsequent revisions.

NAS/DOE NATIONAL ACADEMY OF SCIENCES.
"DOE METHODS FOR EVALUATING ENVIRONMENTAL AND WASTE MANAGEMENT
SAMPLE" OCTOBER 1994 US DEPARTMENT OF ENERGY.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical
Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

F2I130297

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
E78LM	001	SS530001XX	09/11/02	12:15
E78L4	002	SS540001XX	09/11/02	12:45
E78L8	003	SS540101XX	09/11/02	14:15
E78MC	004	SS550001XX	09/11/02	14:30
E78ME	005	SS560001XX	09/11/02	14:50
E78MG	006	SS560101XX	09/11/02	15:00
E78MJ	007	SS560101XL	09/11/02	15:10
E78ML	008	SS570001XX	09/11/02	15:15
E78MP	009	SS580001XX	09/11/02	15:30
E78MQ	010	SS580001XD	09/11/02	15:30
E78MT	011	SS580101XX	09/11/02	15:40
E78MW	012	SS580101XD	09/11/02	15:40
E78MX	013	SS590001XX	09/11/02	17:00
E78M1	014	SS600001XX	09/11/02	17:10
E78M3	015	SS590101XX	09/11/02	17:30
E78M4	016	B250702XX	09/12/02	11:00
E78P3	017	B250702XF	09/12/02	11:00
E78P4	018	B310702XX	09/12/02	12:25
E78P7	019	B310702XF	09/12/02	12:25

NOTE(S) :

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

STL ST. LOUIS

HARDING RSE

Client Sample ID: SS530001XX

General Chemistry

Lot-Sample #....: F2I130297-001 Work Order #....: E78LM Matrix.....: SOLID
Date Sampled....: 09/11/02 12:15 Date Received...: 09/13/02
% Moisture.....: 9.4

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	9.4	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461

Dilution Factor: 1 Analysis Time...: 00:04

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS540001XX

General Chemistry

Lot-Sample #....: F2I130297-002 Work Order #....: E78L4 Matrix.....: SOLID
Date Sampled....: 09/11/02 12:45 Date Received...: 09/13/02
% Moisture.....: 9.2

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	9.2	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461
		Dilution Factor: 1		Analysis Time...: 00:04		

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS540101XX

General Chemistry

Lot-Sample #....: F2I130297-003 Work Order #....: E78L8 Matrix.....: SOLID
Date Sampled....: 09/11/02 14:15 Date Received...: 09/13/02
% Moisture.....: 9.1

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	9.1	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461

Dilution Factor: 1 Analysis Time...: 00:04

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS550001XX

General Chemistry

Lot-Sample #....: F2I130297-004 Work Order #....: E78MC Matrix.....: SOLID
Date Sampled....: 09/11/02 14:30 Date Received...: 09/13/02
% Moisture.....: 9.9

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION- ANALYSIS DATE	PREP BATCH #
Percent Moisture	9.9	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461

Dilution Factor: 1 Analysis Time...: 00:04

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS560001XX

General Chemistry

Lot-Sample #....: F2I130297-005 Work Order #....: E78ME Matrix.....: SOLID
Date Sampled....: 09/11/02 14:50 Date Received...: 09/13/02
% Moisture.....: 9.2

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	9.2	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461

Dilution Factor: 1 Analysis Time...: 00:04

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS560101XX

General Chemistry

Lot-Sample #....: F2I130297-006 Work Order #....: E78MG Matrix.....: SOLID
Date Sampled....: 09/11/02 15:00 Date Received...: 09/13/02
% Moisture.....: 7.0

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	7.0	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461

Dilution Factor: 1 Analysis Time..: 00:04

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS560101XL

General Chemistry

Lot-Sample #....: F2I130297-007 Work Order #....: E78MJ Matrix.....: SOLID
Date Sampled....: 09/11/02 15:10 Date Received...: 09/13/02
% Moisture.....: 5.4

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	5.4	0.10	%	MCAWW 160.3 MOD	09/30-10/01/02	2273477
		Dilution Factor: 1		Analysis Time...: 00:04		

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS570001XX

General Chemistry

Lot-Sample #....: F2I130297-008 Work Order #....: E78ML Matrix.....: SOLID
Date Sampled....: 09/11/02 15:15 Date Received...: 09/13/02
% Moisture.....: 8.6

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	8.6	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461
		Dilution Factor: 1		Analysis Time...: 00:04		

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS580001XX

General Chemistry

Lot-Sample #....: F2I130297-009 Work Order #....: E78MP Matrix.....: SOLID
Date Sampled....: 09/11/02 15:30 Date Received...: 09/13/02
% Moisture.....: 9.0

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	9.0	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461
		Dilution Factor: 1		Analysis Time...: 00:04		

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS580001XD

General Chemistry

Lot-Sample #....: F2I130297-010 Work Order #....: E78MQ Matrix.....: SOLID
Date Sampled....: 09/11/02 15:30 Date Received...: 09/13/02
% Moisture.....: 8.9

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	8.9	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461
		Dilution Factor: 1		Analysis Time...: 00:04		

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS580101XX

General Chemistry

Lot-Sample #....: F2I130297-011 Work Order #....: E78MT Matrix.....: SOLID
Date Sampled....: 09/11/02 15:40 Date Received...: 09/13/02
% Moisture.....: 8.4

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	8.4	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461

Dilution Factor: 1 Analysis Time...: 00:04

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS580101XD

General Chemistry

Lot-Sample #....: F2I130297-012 Work Order #....: E78MW Matrix.....: SOLID
Date Sampled....: 09/11/02 15:40 Date Received...: 09/13/02
% Moisture.....: 8.1

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	8.1	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461

Dilution Factor: 1 Analysis Time...: 00:04

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS590001XX

General Chemistry

Lot-Sample #....: F2I130297-013 Work Order #....: E78MX Matrix.....: SOLID
Date Sampled....: 09/11/02 17:00 Date Received...: 09/13/02
% Moisture.....: 17

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	17.1	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461
		Dilution Factor: 1		Analysis Time...: 00:04		

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS600001XX

General Chemistry

Lot-Sample #....: F2I130297-014 Work Order #....: E78M1 Matrix.....: SOLID
Date Sampled....: 09/11/02 17:10 Date Received...: 09/13/02
% Moisture.....: 12

<u>PARAMETER</u>	<u>RESULT</u>	<u>RL</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>PREP BATCH #</u>
Percent Moisture	11.6	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461
		Dilution Factor: 1		Analysis Time...: 00:04		

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: SS590101XX

General Chemistry

Lot-Sample #...: F2I130297-015 Work Order #...: E78M3 Matrix.....: SOLID
Date Sampled...: 09/11/02 17:30 Date Received...: 09/13/02
% Moisture.....: 18

PARAMETER	RESULT	RL	UNITS	METHOD	PREPARATION- ANALYSIS DATE	PREP BATCH #
Percent Moisture	17.8	0.10	%	MCAWW 160.3 MOD	09/27-09/30/02	2270461

Dilution Factor: 1 Analysis Time...: 00:04

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: B250702XX

TOTAL Metals

Lot-Sample #....: F2I130297-016

Matrix.....: WATER

Date Sampled....: 09/12/02 11:00 Date Received...: 09/13/02

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING</u> <u>LIMIT</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION-</u> <u>ANALYSIS DATE</u>	<u>WORK</u> <u>ORDER #</u>
Prep Batch #....: 2266244						
Lead	ND	100	ug/L	SW846 6010B	09/23-09/25/02	E78M41AA
		Dilution Factor: 1		Analysis Time...: 01:11		

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: B250702XF

TOTAL Metals

Lot-Sample #....: F2I130297-017

Matrix.....: WATER

Date Sampled....: 09/12/02 11:00 Date Received...: 09/13/02

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING</u> <u>LIMIT</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION-</u> <u>ANALYSIS DATE</u>	<u>WORK</u> <u>ORDER #</u>
Prep Batch #....: 2266244						
Lead	ND	100	ug/L	SW846 6010B	09/23-09/25/02	E78P31AA
		Dilution Factor: 1		Analysis Time...: 01:16		

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: B310702XX

TOTAL Metals

Lot-Sample #...: F2I130297-018

Matrix.....: WATER

Date Sampled...: 09/12/02 12:25 Date Received...: 09/13/02

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING</u> <u>LIMIT</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION-</u> <u>ANALYSIS DATE</u>	<u>WORK</u> <u>ORDER #</u>
Prep Batch #...: 2266244						
Lead	ND	100	ug/L	SW846 6010B	09/23-09/25/02	E78P41AA
		Dilution Factor: 1		Analysis Time...: 01:20		

LOT # F2I130297

STL ST. LOUIS

HARDING ESE

Client Sample ID: B310702XF

TOTAL Metals

Lot-Sample #....: F2I130297-019

Matrix.....: WATER

Date Sampled....: 09/12/02 12:25 Date Received...: 09/13/02

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING</u> <u>LIMIT</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION-</u> <u>ANALYSIS DATE</u>	<u>WORK</u> <u>ORDER #</u>
Prep Batch #....: 2266244						
Lead	ND	100	ug/L	SW846 6010B	09/23-09/25/02	E78P71AA
		Dilution Factor: 1		Analysis Time...: 01:25		

LOT # F2I130297

METHOD BLANK REPORT

TOTAL Metals

Client Lot #....: F2I130297

Matrix.....: WATER

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING</u> <u>LIMIT</u>	<u>UNITS</u>	<u>METHOD</u>	<u>PREPARATION-</u> <u>ANALYSIS DATE</u>	<u>WORK</u> <u>ORDER #</u>
MB Lot-Sample #: F2I230000-244 Prep Batch #....: 2266244						
Lead	ND	100	ug/L	SW846 6010B	09/23-09/25/02	E8NJK1A3
Dilution Factor: 1						
Analysis Time...: 00:57						

NOTE(S) :

Calculations are performed before rounding to avoid round-off errors in calculated results.

LABORATORY CONTROL SAMPLE EVALUATION REPORT

TOTAL Metals

Client Lot #...: F2I130297

Matrix.....: WATER

<u>PARAMETER</u>	<u>PERCENT RECOVERY</u>	<u>RECOVERY LIMITS</u>	<u>METHOD</u>	<u>PREPARATION- ANALYSIS DATE</u>	<u>WORK ORDER #</u>
LCS Lot-Sample#:	F2I230000-244	Prep Batch #...	2266244		
Lead	98	(80 - 120)	SW846 6010B	09/23-09/25/02	E8NJK1C3
		Dilution Factor: 1	Analysis Time...	01:02	

NOTE(S) :

Calculations are performed before rounding to avoid round-off errors in calculated results.

SAMPLE DUPLICATE EVALUATION REPORT

General Chemistry

Client Lot #....: F2I130297 Work Order #....: E78MX-SMP Matrix.....: SOLID
E78MX-DUP

Date Sampled....: 09/11/02 17:00 Date Received...: 09/13/02

% Moisture.....: 17

<u>PARAM</u>	<u>RESULT</u>	<u>DUPLICATE</u> <u>RESULT</u>	<u>UNITS</u>	<u>RPD</u> <u>RPD</u>	<u>LIMIT</u>	<u>METHOD</u>	<u>PREPARATION-</u> <u>ANALYSIS DATE</u>	<u>PREP</u> <u>BATCH #</u>
Percent Moisture						SD Lot-Sample #:	F2I130297-013	
17.1		17.2	%	0.52	(0-30)	MCAWW 160.3 MOD	09/27-09/30/02	2270461
			Dilution Factor: 1			Analysis Time...: 00:04		

HARDING ESE

Client Sample ID: SS530001XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-001
 Work Order: E78LM
 Matrix: SOLID

Date Collected: 09/11/02 1215
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	4.30		0.52	0.06	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	1.28		0.37	0.14	09/16/02	09/26/02	2259207	
Bismuth 214	3.99		0.48	0.06	09/16/02	09/26/02	2259207	
Cesium 137	0.05		0.17	0.03	09/16/02	09/26/02	2259207	
Lead 210	3.34		0.72	0.59	09/16/02	09/26/02	2259207	
Lead 212	1.20		0.16	0.05	09/16/02	09/26/02	2259207	
Lead 214	4.28		0.51	0.07	09/16/02	09/26/02	2259207	
Potassium 40	2.07		0.57	0.42	09/16/02	09/26/02	2259207	
Protactinium 234M	4.8		3.8	3.9	09/16/02	09/26/02	2259207	
Radium 228	0.99		0.19	0.14	09/16/02	09/26/02	2259207	
Thallium 208	0.97		0.25	0.1	09/16/02	09/26/02	2259207	
Thorium 231	1.01		0.21	0.38	09/16/02	09/26/02	2259207	
Thorium 232	0.98		0.19	0.05	09/16/02	09/26/02	2259207	
Thorium 234	4.41		0.63	0.36	09/16/02	09/26/02	2259207	
Uranium 238	3.63		0.70	0.36	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.64		0.14	0.02	10/09/02	10/26/02	2280430	95
Thorium 230	0.72		0.15	0.01	10/09/02	10/26/02	2280430	95
Thorium 232	0.61		0.13	0.02	10/09/02	10/26/02	2280430	95
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.43		0.11	0.02	10/09/02	10/26/02	2280435	68
Uranium 235	0.059	J	0.030	0.019	10/09/02	10/26/02	2280435	68
Uranium 238	0.74		0.16	0.02	10/09/02	10/26/02	2280435	68

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

HARDING ESE

Client Sample ID: SS530001XX DUP

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-001X
 Work Order: E78LM
 Matrix: SOLID

Date Collected: 09/11/02 1215
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	4.17		0.52	0.06	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	1.19		0.36	0.14	09/16/02	09/26/02	2259207	
Bismuth 212	1.31		0.47	0.50	09/16/02	09/26/02	2259207	
Bismuth 214	4.03		0.51	0.07	09/16/02	09/26/02	2259207	
Cesium 137	0.048		0.017	0.038	09/16/02	09/26/02	2259207	
Lead 210	2.99		0.84	0.67	09/16/02	09/26/02	2259207	
Lead 212	1.17		0.15	0.05	09/16/02	09/26/02	2259207	
Lead 214	4.09		0.50	0.07	09/16/02	09/26/02	2259207	
Potassium 40	2.02		0.56	0.37	09/16/02	09/26/02	2259207	
Protactinium 234M	6.5		3.8	4.4	09/16/02	09/26/02	2259207	
Radium 228	0.88		0.21	0.14	09/16/02	09/26/02	2259207	
Thallium 208	1.10		0.28	0.12	09/16/02	09/26/02	2259207	
Thorium 231	1.62		0.35	0.38	09/16/02	09/26/02	2259207	
Thorium 232	0.88		0.20	0.05	09/16/02	09/26/02	2259207	
Thorium 234	2.68		0.41	0.46	09/16/02	09/26/02	2259207	
Uranium 238	3.65		0.83	0.46	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.64		0.14	0.04	10/09/02	10/26/02	2280430	91
Thorium 230	0.69		0.15	0.02	10/09/02	10/26/02	2280430	91
Thorium 232	0.64		0.14	0.02	10/09/02	10/26/02	2280430	91
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.52		0.12	0.02	10/09/02	10/26/02	2280435	70
Uranium 235	0.030	J	0.022	0.028	10/09/02	10/26/02	2280435	70
Uranium 238	0.87		0.18	0.03	10/09/02	10/26/02	2280435	70

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

HARDING ESE

Client Sample ID: SS540001XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-002
 Work Order: E78L4
 Matrix: SOLID

Date Collected: 09/11/02 1245
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	1.0		0.16	0.06	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	4.4		1.2	0.1	09/16/02	09/26/02	2259207	
Bismuth 212	4.96		0.78	0.54	09/16/02	09/26/02	2259207	
Bismuth 214	1.09		0.15	0.06	09/16/02	09/26/02	2259207	
Lead 212	4.18		0.52	0.05	09/16/02	09/26/02	2259207	
Lead 214	1.04		0.14	0.06	09/16/02	09/26/02	2259207	
Radium 228	3.66		0.46	0.11	09/16/02	09/26/02	2259207	
Radium 223	0.52		0.29	0.15	09/16/02	09/26/02	2259207	
Thallium 208	3.89		0.90	0.09	09/16/02	09/26/02	2259207	
Thorium 231	1.24		0.23	0.32	09/16/02	09/26/02	2259207	
Thorium 232	3.64		0.46	0.05	09/16/02	09/26/02	2259207	
Thorium 234	4.01		0.70	0.35	09/16/02	09/26/02	2259207	
Uranium 238	2.18		0.95	0.35	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	6.4		1.2	0.04	10/09/02	10/26/02	2280430	91
Thorium 230	1.66		0.33	0.01	10/09/02	10/26/02	2280430	91
Thorium 232	6.0		1.1	0.01	10/09/02	10/26/02	2280430	91
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	1.39		0.28	0.02	10/09/02	10/26/02	2280435	92
Uranium 235	0.096	J	0.037	0.020	10/09/02	10/26/02	2280435	92
Uranium 238	2.12		0.42	0.02	10/09/02	10/26/02	2280435	92

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

HARDING ESE

Client Sample ID: SS540101XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-003

Date Collected: 09/11/02 1415

Work Order: E78L8

Date Received: 09/13/02 0940

Matrix: SOLID

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	1.0		0.14	0.06	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	2.41		0.65	0.12	09/16/02	09/26/02	2259207	
Bismuth 214	0.98		0.14	0.06	09/16/02	09/26/02	2259207	
Cesium 137	0.285		0.055	0.034	09/16/02	09/26/02	2259207	
Lead 210	1.05		0.68	0.56	09/16/02	09/26/02	2259207	
Lead 212	2.08		0.26	0.05	09/16/02	09/26/02	2259207	
Lead 214	1.11		0.15	0.06	09/16/02	09/26/02	2259207	
Potassium 40	5.04		0.76	0.27	09/16/02	09/26/02	2259207	
Radium 228	1.59		0.25	0.12	09/16/02	09/26/02	2259207	
Thallium 208	1.75		0.43	0.09	09/16/02	09/26/02	2259207	
Thorium 231	0.77		0.18	0.32	09/16/02	09/26/02	2259207	
Thorium 232	1.58		0.25	0.05	09/16/02	09/26/02	2259207	
Thorium 234	2.54		0.39	0.39	09/16/02	09/26/02	2259207	
Uranium 238	1.23		0.60	0.39	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	2.79		0.55	0.04	10/09/02	10/26/02	2280430	89
Thorium 230	1.21		0.25	0.02	10/09/02	10/26/02	2280430	89
Thorium 232	2.68		0.53	0.02	10/09/02	10/26/02	2280430	89
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.91		0.20	0.03	10/09/02	10/27/02	2280435	73
Uranium 235	0.080	J	0.041	0.035	10/09/02	10/27/02	2280435	73
Uranium 238	1.14		0.25	0.02	10/09/02	10/27/02	2280435	73

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

HARDING ESE

Client Sample ID: SS550001XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-004
 Work Order: E78MC
 Matrix: SOLID

Date Collected: 09/11/02 1430
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	2.89		0.37	0.05	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	0.65		0.22	0.13	09/16/02	09/26/02	2259207	
Bismuth 212	0.89		0.35	0.56	09/16/02	09/26/02	2259207	
Bismuth 214	2.77		0.36	0.06	09/16/02	09/26/02	2259207	
Cesium 137	0.061		0.017	0.030	09/16/02	09/26/02	2259207	
Lead 210	2.04		0.56	0.55	09/16/02	09/26/02	2259207	
Lead 212	0.707		0.096	0.051	09/16/02	09/26/02	2259207	
Lead 214	2.91		0.36	0.05	09/16/02	09/26/02	2259207	
Potassium 40	1.26		0.42	0.39	09/16/02	09/26/02	2259207	
Protactinium 234M	6.8		3.0	3.8	09/16/02	09/26/02	2259207	
Radium 228	0.77		0.19	0.13	09/16/02	09/26/02	2259207	
Thallium 208	0.63		0.18	0.09	09/16/02	09/26/02	2259207	
Thorium 232	0.76		0.19	0.05	09/16/02	09/26/02	2259207	
Thorium 234	2.75		0.41	0.38	09/16/02	09/26/02	2259207	
Uranium 238	3.4		1.1	0.4	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.375		0.087	0.015	10/09/02	10/26/02	2280430	93
Thorium 230	0.46		0.10	0.02	10/09/02	10/26/02	2280430	93
Thorium 232	0.352		0.082	0.013	10/09/02	10/26/02	2280430	93
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.347		0.083	0.016	10/09/02	10/27/02	2280435	81
Uranium 235	0.016	U	0.015	0.022	10/09/02	10/27/02	2280435	81
Uranium 238	0.351		0.084	0.013	10/09/02	10/27/02	2280435	81

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

U Result is less than the sample detection limit.

HARDING ESE

Client Sample ID: SS560001XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-005
 Work Order: E78ME
 Matrix: SOLID

Date Collected: 09/11/02 1450
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	6.93		0.81	0.08	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	1.82		0.54	0.21	09/16/02	09/26/02	2259207	
Bismuth 214	6.92		0.86	0.08	09/16/02	09/26/02	2259207	
Cesium 137	0.060		0.021	0.047	09/16/02	09/26/02	2259207	
Lead 210	4.05		0.88	0.78	09/16/02	09/26/02	2259207	
Lead 212	1.37		0.18	0.09	09/16/02	09/26/02	2259207	
Lead 214	7.28		0.87	0.09	09/16/02	09/26/02	2259207	
Potassium 40	1.28		0.65	0.56	09/16/02	09/26/02	2259207	
Protactinium 234M	10.9		7.0	6.2	09/16/02	09/26/02	2259207	
Radium 228	1.29		0.28	0.21	09/16/02	09/26/02	2259207	
Thallium 208	1.09		0.30	0.16	09/16/02	09/26/02	2259207	
Thorium 231	1.42		0.27	0.47	09/16/02	09/26/02	2259207	
Thorium 232	1.28		0.28	0.08	09/16/02	09/26/02	2259207	
Thorium 234	6.77		0.94	0.57	09/16/02	09/26/02	2259207	
Uranium 238	6.2		1.1	0.6	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.56		0.14	0.04	10/09/02	10/27/02	2280430	76
Thorium 230	0.80		0.18	0.02	10/09/02	10/27/02	2280430	76
Thorium 232	0.47		0.12	0.02	10/09/02	10/27/02	2280430	76
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.53		0.12	0.02	10/09/02	10/27/02	2280435	76
Uranium 235	0.044	J	0.024	0.021	10/09/02	10/27/02	2280435	76
Uranium 238	0.67		0.15	0.02	10/09/02	10/27/02	2280435	76

NOTE (S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

HARDING ESE

Client Sample ID: SS560101XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-006
 Work Order: E78MG
 Matrix: SOLID

Date Collected: 09/11/02 1500
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	5.37		0.62	0.08	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	1.37		0.41	0.17	09/16/02	09/26/02	2259207	
Bismuth 214	5.07		0.65	0.08	09/16/02	09/26/02	2259207	
Lead 210	3.73		0.73	0.73	09/16/02	09/26/02	2259207	
Lead 212	1.22		0.16	0.07	09/16/02	09/26/02	2259207	
Lead 214	5.37		0.64	0.08	09/16/02	09/26/02	2259207	
Potassium 40	0.57		0.55	0.45	09/16/02	09/26/02	2259207	
Radium 228	1.14		0.25	0.17	09/16/02	09/26/02	2259207	
Radium 223	0.62		0.34	0.20	09/16/02	09/26/02	2259207	
Thallium 208	1.06		0.28	0.12	09/16/02	09/26/02	2259207	
Thorium 231	1.18		0.25	0.41	09/16/02	09/26/02	2259207	
Thorium 232	1.14		0.25	0.07	09/16/02	09/26/02	2259207	
Thorium 234	5.69		0.80	0.50	09/16/02	09/26/02	2259207	
Uranium 238	5.1		1.2	0.5	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.69		0.15	0.04	10/09/02	10/27/02	2280430	97
Thorium 230	0.74		0.16	0.006	10/09/02	10/27/02	2280430	97
Thorium 232	0.65		0.14	0.01	10/09/02	10/27/02	2280430	97
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.55		0.12	0.02	10/09/02	10/27/02	2280435	71
Uranium 235	0.041	J	0.025	0.028	10/09/02	10/27/02	2280435	71
Uranium 238	0.66		0.15	0.02	10/09/02	10/27/02	2280435	71

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

HARDING ESE

Client Sample ID: SS560101XL

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-007

Work Order: E78MJ

Matrix: SOLID

Date Collected: 09/11/02 1510

Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	4.04		0.77	0.26	09/16/02	09/26/02	2259332	
--- Other Detected Radionuclides ---								
Bismuth 214	3.77		0.65	0.29	09/16/02	09/26/02	2259332	
Lead 212	0.81		0.18	0.20	09/16/02	09/26/02	2259332	
Lead 214	3.92		0.67	0.26	09/16/02	09/26/02	2259332	
Radium 228	0.68	U	0.48	0.95	09/16/02	09/26/02	2259332	
Thallium 208	0.97		0.40	0.73	09/16/02	09/26/02	2259332	
Thorium 232	0.68		0.48	0.36	09/16/02	09/26/02	2259332	
Thorium 234	3.8		1.7	1.5	09/16/02	09/26/02	2259332	
Uranium 238	4.0		2.6	1.5	09/16/02	09/26/02	2259332	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.56		0.13	0.04	10/09/02	10/27/02	2280430	106
Thorium 230	0.70		0.15	0.02	10/09/02	10/27/02	2280430	106
Thorium 232	0.46		0.11	0.02	10/09/02	10/27/02	2280430	106
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.71		0.16	0.02	10/09/02	10/27/02	2280435	78
Uranium 235	0.056	J	0.028	0.021	10/09/02	10/27/02	2280435	78
Uranium 238	0.88		0.19	0.01	10/09/02	10/27/02	2280435	78

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

U Result is less than the sample detection limit.

HARDING ESE

Client Sample ID: SS560101XL DUP

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-007X
Work Order: E78MJ
Matrix: SOLID

Date Collected: 09/11/02 1510
Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g		300 MOD		
Radium (226)	4.07		0.72	0.25	09/16/02	09/26/02	2259332	
--- Other Detected Radionuclides ---								
Bismuth 214	3.98		0.69	0.26	09/16/02	09/26/02	2259332	
Lead 212	0.76		0.18	0.22	09/16/02	09/26/02	2259332	
Lead 214	4.38		0.66	0.24	09/16/02	09/26/02	2259332	
Radium 228	0.96		0.59	0.92	09/16/02	09/26/02	2259332	
Thallium 208	0.78		0.40	0.67	09/16/02	09/26/02	2259332	
Thorium 232	0.96		0.59	0.37	09/16/02	09/26/02	2259332	
Thorium 234	2.45		0.88	2.1	09/16/02	09/26/02	2259332	
Uranium 238	2.6		1.7	2.1	09/16/02	09/26/02	2259332	

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

HARDING ESE

Client Sample ID: SS570001XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-008
 Work Order: E78ML
 Matrix: SOLID

Date Collected: 09/11/02 1515
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	2.83		0.36	0.06	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	1.06		0.32	0.13	09/16/02	09/26/02	2259207	
Bismuth 214	2.57		0.34	0.06	09/16/02	09/26/02	2259207	
Cesium 137	0.12		0.22	0.10	09/16/02	09/26/02	2259207	
Lead 210	2.54		0.77	0.60	09/16/02	09/26/02	2259207	
Lead 212	0.97		0.13	0.05	09/16/02	09/26/02	2259207	
Lead 214	2.68		0.33	0.06	09/16/02	09/26/02	2259207	
Potassium 40	6.55		0.96	0.35	09/16/02	09/26/02	2259207	
Radium 228	0.90		0.20	0.13	09/16/02	09/26/02	2259207	
Thallium 208	0.82		0.22	0.10	09/16/02	09/26/02	2259207	
Thorium 231	0.59		0.17	0.34	09/16/02	09/26/02	2259207	
Thorium 232	0.89		0.20	0.05	09/16/02	09/26/02	2259207	
Thorium 234	2.98		0.47	0.41	09/16/02	09/26/02	2259207	
Uranium 238	2.99		0.63	0.41	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.84		0.18	0.02	10/09/02	10/27/02	2280430	93
Thorium 230	0.72		0.16	0.02	10/09/02	10/27/02	2280430	93
Thorium 232	0.82		0.18	0.01	10/09/02	10/27/02	2280430	93
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.65		0.14	0.03	10/09/02	10/27/02	2280435	69
Uranium 235	0.043	J	0.026	0.025	10/09/02	10/27/02	2280435	69
Uranium 238	1.12		0.23	0.02	10/09/02	10/27/02	2280435	69

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

HARDING ESE

Client Sample ID: SS580001XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-009
 Work Order: E78MP
 Matrix: SOLID

Date Collected: 09/11/02 1530
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	13.9		1.6	0.1	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	3.30		0.91	0.27	09/16/02	09/26/02	2259207	
Bismuth 214	13.8		1.7	0.1	09/16/02	09/26/02	2259207	
Cesium 137	0.078		0.026	0.062	09/16/02	09/26/02	2259207	
Lead 210	7.3		1.4	1.0	09/16/02	09/26/02	2259207	
Lead 212	3.11		0.38	0.1	09/16/02	09/26/02	2259207	
Lead 214	14.4		1.7	0.1	09/16/02	09/26/02	2259207	
Potassium 40	2.70		0.84	0.71	09/16/02	09/26/02	2259207	
Protactinium 234M	12.2		7.9	7.7	09/16/02	09/26/02	2259207	
Radium 228	2.60		0.50	0.27	09/16/02	09/26/02	2259207	
Radium 223	1.07		0.76	0.30	09/16/02	09/26/02	2259207	
Thallium 208	2.60		0.63	0.19	09/16/02	09/26/02	2259207	
Thorium 231	4.33		0.69	0.62	09/16/02	09/26/02	2259207	
Thorium 232	2.59		0.50	0.09	09/16/02	09/26/02	2259207	
Thorium 234	15.4		2.1	0.8	09/16/02	09/26/02	2259207	
Uranium 235	0.74		0.34	0.38	09/16/02	09/26/02	2259207	
Uranium 238	13.4		2.2	0.8	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	1.12		0.24	0.04	10/09/02	10/26/02	2280430	82
Thorium 230	1.10		0.24	0.02	10/09/02	10/26/02	2280430	82
Thorium 232	0.94		0.21	0.02	10/09/02	10/26/02	2280430	82
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.98		0.21	0.03	10/09/02	10/26/02	2280435	72
Uranium 235	0.067	J	0.036	0.036	10/09/02	10/26/02	2280435	72
Uranium 238	1.64		0.34	0.008	10/09/02	10/26/02	2280435	72

NOTE(S)

Data are incomplete without the case narrative.

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Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

HARDING ESE

Client Sample ID: SS580001XD

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-010
 Work Order: E78MQ
 Matrix: SOLID

Date Collected: 09/11/02 1530
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	14.6		1.7	0.1	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 227	0.58		0.15	0.32	09/16/02	09/26/02	2259207	
Actinium 228	3.16		0.85	0.25	09/16/02	09/26/02	2259207	
Bismuth 212	3.74		0.97	0.83	09/16/02	09/26/02	2259207	
Bismuth 214	14.5		1.7	0.1	09/16/02	09/26/02	2259207	
Cesium 137	0.101		0.028	0.062	09/16/02	09/26/02	2259207	
Lead 210	7.8		1.3	1	09/16/02	09/26/02	2259207	
Lead 212	3.28		0.41	0.09	09/16/02	09/26/02	2259207	
Lead 214	14.7		1.7	0.1	09/16/02	09/26/02	2259207	
Potassium 40	2.54		0.88	0.67	09/16/02	09/26/02	2259207	
Protactinium 234M	16.8		7.9	7.9	09/16/02	09/26/02	2259207	
Radium 228	2.83		0.44	0.25	09/16/02	09/26/02	2259207	
Radium 223	0.83		0.74	0.29	09/16/02	09/26/02	2259207	
Thallium 208	2.82		0.66	0.16	09/16/02	09/26/02	2259207	
Thorium 231	3.14		0.50	0.56	09/16/02	09/26/02	2259207	
Thorium 232	2.82		0.44	0.09	09/16/02	09/26/02	2259207	
Thorium 234	13.8		1.9	0.6	09/16/02	09/26/02	2259207	
Uranium 235	0.96		0.49	0.35	09/16/02	09/26/02	2259207	
Uranium 238	12.4		1.9	0.6	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.92		0.20	0.04	10/09/02	10/26/02	2280430	93
Thorium 230	0.85		0.18	0.01	10/09/02	10/26/02	2280430	93
Thorium 232	0.90		0.19	0.01	10/09/02	10/26/02	2280430	93
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.82		0.18	0.03	10/09/02	10/26/02	2280435	84
Uranium 235	0.080	J	0.034	0.027	10/09/02	10/26/02	2280435	84
Uranium 238	1.64		0.33	0.02	10/09/02	10/26/02	2280435	84

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

HARDING ESE

Client Sample ID: SS580101XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-011
 Work Order: E78MT
 Matrix: SOLID

Date Collected: 09/11/02 1540
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	16.5		1.9	0.1	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 227	0.80		0.18	0.41	09/16/02	09/26/02	2259207	
Actinium 228	4.0		1.1	0.3	09/16/02	09/26/02	2259207	
Bismuth 214	16.7		2.0	0.1	09/16/02	09/26/02	2259207	
Lead 210	7.0		1.5	1.1	09/16/02	09/26/02	2259207	
Lead 212	3.53		0.44	0.11	09/16/02	09/26/02	2259207	
Lead 214	17.4		2.1	0.1	09/16/02	09/26/02	2259207	
Potassium 40	1.84		0.90	0.82	09/16/02	09/26/02	2259207	
Protactinium 234M	13.5		9.3	9.4	09/16/02	09/26/02	2259207	
Radium 228	2.90		0.51	0.30	09/16/02	09/26/02	2259207	
Radium 223	1.99		0.95	0.36	09/16/02	09/26/02	2259207	
Thallium 208	3.43		0.86	0.20	09/16/02	09/26/02	2259207	
Thorium 231	1.91		0.30	0.68	09/16/02	09/26/02	2259207	
Thorium 232	2.89		0.51	0.11	09/16/02	09/26/02	2259207	
Thorium 234	12.6		1.7	0.8	09/16/02	09/26/02	2259207	
Uranium 235	0.73		0.36	0.43	09/16/02	09/26/02	2259207	
Uranium 238	13.6		2.1	0.8	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.86		0.19	0.04	10/09/02	10/26/02	2280430	96
Thorium 230	0.99		0.21	0.02	10/09/02	10/26/02	2280430	96
Thorium 232	0.87		0.19	0.02	10/09/02	10/26/02	2280430	96
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.81		0.17	0.006	10/09/02	10/26/02	2280435	78
Uranium 235	0.071	J	0.031	0.017	10/09/02	10/26/02	2280435	78
Uranium 238	1.26		0.26	0.02	10/09/02	10/26/02	2280435	78

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

HARDING ESE

Client Sample ID: SS580101XD

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-012
 Work Order: E78MW
 Matrix: SOLID

Date Collected: 09/11/02 1540
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	16.9		2.0	0.1	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 227	0.85		0.17	0.35	09/16/02	09/26/02	2259207	
Actinium 228	4.0		1.1	0.2	09/16/02	09/26/02	2259207	
Bismuth 212	4.0		1.1	0.9	09/16/02	09/26/02	2259207	
Bismuth 214	16.0		2.0	0.1	09/16/02	09/26/02	2259207	
Lead 210	6.1		1.2	1.1	09/16/02	09/26/02	2259207	
Lead 212	3.33		0.41	0.10	09/16/02	09/26/02	2259207	
Lead 214	16.7		2.0	0.1	09/16/02	09/26/02	2259207	
Potassium 40	2.16		0.80	0.70	09/16/02	09/26/02	2259207	
Protactinium 234M	20.5		7.4	7.5	09/16/02	09/26/02	2259207	
Radium 228	2.66		0.48	0.24	09/16/02	09/26/02	2259207	
Radium 223	1.37		0.77	0.32	09/16/02	09/26/02	2259207	
Thallium 208	3.16		0.74	0.17	09/16/02	09/26/02	2259207	
Thorium 231	1.13		0.19	0.60	09/16/02	09/26/02	2259207	
Thorium 232	2.65		0.48	0.1	09/16/02	09/26/02	2259207	
Thorium 234	12.0		1.6	0.7	09/16/02	09/26/02	2259207	
Uranium 235	0.93		0.38	0.39	09/16/02	09/26/02	2259207	
Uranium 238	11.9		2.0	0.7	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.79		0.17	0.02	10/09/02	10/26/02	2280430	96
Thorium 230	0.75		0.16	0.02	10/09/02	10/26/02	2280430	96
Thorium 232	0.69		0.15	0.01	10/09/02	10/26/02	2280430	96
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.61		0.14	0.03	10/09/02	10/25/02	2280435	79
Uranium 235	0.038	J	0.027	0.032	10/09/02	10/25/02	2280435	79
Uranium 238	1.14		0.24	0.007	10/09/02	10/25/02	2280435	79

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

HARDING ESE

Client Sample ID: SS590001XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-013
 Work Order: E78MX
 Matrix: SOLID

Date Collected: 09/11/02 1700
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	0.593		0.092	0.042	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	0.69		0.22	0.09	09/16/02	09/26/02	2259207	
Bismuth 214	0.64		0.11	0.04	09/16/02	09/26/02	2259207	
Cesium 137	0.054		0.026	0.028	09/16/02	09/26/02	2259207	
Lead 210	1.15		0.44	0.45	09/16/02	09/26/02	2259207	
Lead 212	0.643		0.087	0.038	09/16/02	09/26/02	2259207	
Lead 214	0.604		0.099	0.044	09/16/02	09/26/02	2259207	
Potassium 40	13.7		1.7	0.3	09/16/02	09/26/02	2259207	
Radium 228	0.67		0.16	0.09	09/16/02	09/26/02	2259207	
Thallium 208	0.59		0.17	0.07	09/16/02	09/26/02	2259207	
Thorium 232	0.67		0.16	0.04	09/16/02	09/26/02	2259207	
Thorium 234	1.16		0.22	0.29	09/16/02	09/26/02	2259207	
Uranium 238	0.49		0.50	0.29	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.97		0.21	0.05	10/09/02	10/26/02	2280430	91
Thorium 230	0.99		0.21	0.03	10/09/02	10/26/02	2280430	91
Thorium 232	0.99		0.21	0.007	10/09/02	10/26/02	2280430	91
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.86		0.20	0.04	10/09/02	10/25/02	2280435	55
Uranium 235	0.023	U	0.025	0.041	10/09/02	10/25/02	2280435	55
Uranium 238	1.03		0.23	0.04	10/09/02	10/25/02	2280435	55

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

U Result is less than the sample detection limit.

HARDING ESE

Client Sample ID: SS600001XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-014
 Work Order: E78M1
 Matrix: SOLID

Date Collected: 09/11/02 1710
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	1.56		0.22	0.06	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	1.03		0.31	0.13	09/16/02	09/26/02	2259207	
Bismuth 214	1.43		0.19	0.06	09/16/02	09/26/02	2259207	
Cesium 137	0.217		0.037	0.031	09/16/02	09/26/02	2259207	
Lead 210	2.31		0.64	0.50	09/16/02	09/26/02	2259207	
Lead 212	0.95		0.13	0.05	09/16/02	09/26/02	2259207	
Lead 214	1.56		0.20	0.06	09/16/02	09/26/02	2259207	
Potassium 40	11.1		1.4	0.3	09/16/02	09/26/02	2259207	
Radium 228	0.77		0.18	0.13	09/16/02	09/26/02	2259207	
Thallium 208	0.82		0.21	0.08	09/16/02	09/26/02	2259207	
Thorium 232	0.77		0.18	0.04	09/16/02	09/26/02	2259207	
Thorium 234	3.18		0.48	0.33	09/16/02	09/26/02	2259207	
Uranium 238	2.73		0.62	0.33	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	0.93		0.20	0.04	10/09/02	10/25/02	2280430	89
Thorium 230	0.79		0.18	0.02	10/09/02	10/25/02	2280430	89
Thorium 232	0.75		0.17	0.02	10/09/02	10/25/02	2280430	89
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	1.0		0.22	0.03	10/09/02	10/25/02	2280435	51
Uranium 235	0.115		0.049	0.026	10/09/02	10/25/02	2280435	51
Uranium 238	2.54		0.52	0.03	10/09/02	10/25/02	2280435	51

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

HARDING ESE

Client Sample ID: SS590101XX

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I130297-015
 Work Order: E78M3
 Matrix: SOLID

Date Collected: 09/11/02 1730
 Date Received: 09/13/02 0940

Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD				pCi/g	300 MOD			
Radium (226)	0.68		0.11	0.05	09/16/02	09/26/02	2259207	
--- Other Detected Radionuclides ---								
Actinium 228	0.72		0.25	0.14	09/16/02	09/26/02	2259207	
Bismuth 214	0.79		0.13	0.06	09/16/02	09/26/02	2259207	
Lead 210	0.96		0.46	0.55	09/16/02	09/26/02	2259207	
Lead 212	0.76		0.10	0.04	09/16/02	09/26/02	2259207	
Lead 214	0.68		0.11	0.05	09/16/02	09/26/02	2259207	
Potassium 40	15.0		2.0	0.4	09/16/02	09/26/02	2259207	
Radium 228	0.73		0.19	0.14	09/16/02	09/26/02	2259207	
Thallium 208	0.70		0.20	0.08	09/16/02	09/26/02	2259207	
Thorium 232	0.73		0.19	0.04	09/16/02	09/26/02	2259207	
Thorium 234	1.34		0.26	0.32	09/16/02	09/26/02	2259207	
Uranium 238	0.72		0.54	0.32	09/16/02	09/26/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD				pCi/g	3004/RP-725			
Thorium 228	1.09		0.24	0.03	10/09/02	10/25/02	2280430	69
Thorium 230	1.05		0.23	0.03	10/09/02	10/25/02	2280430	69
Thorium 232	0.99		0.22	0.02	10/09/02	10/25/02	2280430	69
Iso URANIUM (LONG CT) NAS & DOE MOD				pCi/g	3050/RP-725			
Uranium 234	0.88		0.20	0.03	10/09/02	10/25/02	2280435	49
Uranium 235	0.035	U	0.030	0.041	10/09/02	10/25/02	2280435	49
Uranium 238	0.98		0.22	0.04	10/09/02	10/25/02	2280435	49

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

U Result is less than the sample detection limit.

METHOD BLANK REPORT

Severn Trent Laboratories - Radiochemistry

Client Lot ID: F2I130297
 Matrix: SOLID

					Lab Sample ID			
Parameter	Result	Qual	Total Uncert. (2 σ +/-)	MDC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Ra-226 & Hits By HASL 300 MOD					pCi/g	300 MOD	F2I160000-332B	
Radium (226)	0.030	U	0.095	0.12	09/16/02	09/26/02	2259332	
Gamma Ra-226 & Hits By HASL 300 MOD					pCi/g	300 MOD	F2I160000-207B	
Radium (226)	0.006	U	0.040	0.061	09/16/02	09/27/02	2259207	
Iso THORIUM (LONG CT) NAS & DOE MOD					pCi/g	3004/RP-725	F2J070000-430B	
Thorium 228	0.031	J	0.021	0.029	10/09/02	10/25/02	2280430	97
Thorium 230	0.077	J	0.027	0.011	10/09/02	10/25/02	2280430	97
Thorium 232	0.0058	U	0.0072	0.011	10/09/02	10/25/02	2280430	97
Iso URANIUM (LONG CT) NAS & DOE MOD					pCi/g	3050/RP-725	F2J070000-435B	
Uranium 234	0.045	U	0.032	0.046	10/09/02	10/25/02	2280435	51
Uranium 235	-0.0069	U	0.0081	0.034	10/09/02	10/25/02	2280435	51
Uranium 238	0.008	U	0.016	0.031	10/09/02	10/25/02	2280435	51

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined using instrument performance only

Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

U Result is less than the sample detection limit.

LOT # F2I130297

Laboratory Control Sample Report

Severn Trent Laboratories - Radiochemistry

Client Lot ID: F2I130297
 Matrix: SOLID

Parameter	Spike Amount	Result	Total Uncert. (2 σ +/-)	MDC	% Yld	% Rec	Lab Sample ID QC Control Limits
Gamma Ra-226 & Hits By HASL 300 MOD			pCi/g	300 MOD			F2I160000-207C
Americium 241	70.0	71.9	7.7	0.4		103	(88 - 117)
Cesium 137	29.5	31.3	3.8	0.2		106	(84 - 112)
Cobalt 60	42.4	44.1	4.7	0.2		104	(89 - 106)
Batch #:			2259207	Analysis Date: 09/27/02			
Gamma Ra-226 & Hits By HASL 300 MOD			pCi/g	300 MOD			F2I160000-332C
Americium 241	70.0	69.1	7.6	0.8		99	(88 - 117)
Cesium 137	29.5	29.1	3.4	0.3		99	(84 - 112)
Cobalt 60	42.4	41.6	4.6	0.2		98	(89 - 106)
Batch #:			2259332	Analysis Date: 09/26/02			
Iso THORIUM (LONG CT) NAS & DOE MOD			pCi/g	3004/RP-725			F2J070000-430C
Thorium 230	24.5	27.0	5.2	0.1	87	110	(64 - 145)
Batch #:			2280430	Analysis Date: 10/25/02			
Iso URANIUM (LONG CT) NAS & DOE MOD			pCi/g	3050/RP-725			F2J070000-435C
Uranium 234	6.20	5.7	1.3	0.2	52	92	(63 - 128)
Uranium 238	6.00	4.3	1.0	0.2	52	72	(63 - 128)
Batch #:			2280435	Analysis Date: 10/25/02			

NOTE(S)

MDC is determined by instrument performance only
 Calculations are performed before rounding to avoid round-off error in calculated results

LOT # F2I130297

DUPLICATE EVALUATION REPORT

Severn Trent Laboratories - Radiochemistry

Client Lot ID: F2I130297

Date Sampled: 09/11/02

Matrix: SOLID

Date Received: 09/13/02

Parameter	SAMPLE Result	Total Uncert. (2σ+/-)	% Yld	DUPLICATE Result	Total Uncert. (2σ+/-)	% Yld	QC Sample ID	Precision
Gamma Ra-226 & Hits By HASL 300 MOD			pCi/g	300 MOD	F2I130297-001			
Radium (226)	4.30	0.52		4.17	0.52		3	%RPD
---Other Dedected Radionuclides---								
Actinium 228	1.28	0.37		1.19	0.36		7	%RPD
Bismuth 214	3.99	0.48		4.03	0.51		1	%RPD
Cesium 137	0.05	0.17		0.048	0.017		5	%RPD
Lead 210	3.34	0.72		2.99	0.84		11	%RPD
Lead 212	1.20	0.16		1.17	0.15		2	%RPD
Lead 214	4.28	0.51		4.09	0.50		4	%RPD
Potassium 40	2.07	0.57		2.02	0.56		2	%RPD
Protactinium 234M	4.8	3.8		6.5	3.8		29	%RPD
Radium 228	0.99	0.19		0.88	0.21		11	%RPD
Thallium 208	0.97	0.25		1.10	0.28		12	%RPD
Thorium 231	1.01	0.21		1.62	0.35		47	%RPD
Thorium 232	0.98	0.19		0.88	0.20		11	%RPD
Thorium 234	4.41	0.63		2.68	0.41		49	%RPD
Uranium 238	3.63	0.70		3.65	0.83		0.4	%RPD
Batch #:			2259207 (Sample)	2259207 (Duplicate)				
Iso THORIUM (LONG CT) NAS & DOE MOD			pCi/g	3004/RP-725	F2I130297-001			
Thorium 228	0.64	0.14	95	0.64	0.14	91	1	%RPD
Thorium 230	0.72	0.15	95	0.69	0.15	91	3	%RPD
Thorium 232	0.61	0.13	95	0.64	0.14	91	5	%RPD
Batch #:			2280430 (Sample)	2280430 (Duplicate)				
Iso URANIUM (LONG CT) NAS & DOE MOD			pCi/g	3050/RP-725	F2I130297-001			
Uranium 234	0.43	0.11	68	0.52	0.12	70	18	%RPD
Uranium 235	0.059	0.030	68	0.030	0.022	70	65	%RPD
Uranium 238	0.74	0.16	68	0.87	0.18	70	16	%RPD
Batch #:			2280435 (Sample)	2280435 (Duplicate)				
Gamma Ra-226 & Hits By HASL 300 MOD			pCi/g	300 MOD	F2I130297-007			
Radium (226)	4.04	0.77		4.07	0.72		0.7	%RPD
---Other Dedected Radionuclides---								
Bismuth 214	3.77	0.65		3.98	0.69		5	%RPD
Lead 212	0.81	0.18		0.76	0.18		7	%RPD
Lead 214	3.92	0.67		4.38	0.66		11	%RPD
Radium 228	0.68	0.48	U	0.96	0.59		34	%RPD
Thallium 208	0.97	0.40		0.78	0.40		22	%RPD
Thorium 232	0.68	0.48		0.96	0.59		34	%RPD
Thorium 234	3.8	1.7		2.45	0.88		44	%RPD
Uranium 238	4.0	2.6		2.6	1.7		45	%RPD
Batch #:			2259332 (Sample)	2259332 (Duplicate)				

STL ST. LOUIS

NOTE(S)

Data are incomplete without the case narrative.

Calculations are performed before rounding to avoid round-off error in calculated results

J Result is greater than sample detection limit but less than stated reporting limit.

U Result is less than the sample detection limit.

LOT # F2I130297

STL ST. LOUIS

PSL20300
Page 1

SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:24
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney

PROJECT #:

REPORT TO: Mark Salvetti

P.O. NUMBER:

SITE: Boston Army Arsenal

AMOUNT REC'D: 500P

STORAGE LOC: RAD

LOT COMMENTS:

MATRIX: SOLID

USAF MATRIX:

SAMPLE ID: SS530001XX

QC PACKAGE: Report

SAMPLE COMMENTS:

QUOTE/SAR #: 49506

LAB ID: F-2I130297-001

WORK ORDER: E78LM

RECEIVING DATE: 9/13/02

SAMPLING DATE: 9/11/02

ANALYTICAL DUE DATE: 10/10/02N

REPORT DUE DATE: 10/11/02

PRIORITY: 27

SAMPLING TIME: 12:15

RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD 10-DAY INGROWTH PREP RC0003, RC0025, CT RD0101 (A-GM-0B-01) E78LM-1-AA Protocol: A QC Program: STANDARD TEST SET	06	9/13/02	0/00/00	3/10/03
Iso THORIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-18-01) E78LM-1-AF Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Iso URANIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-16-01) E78LM-1-AG Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Moisture, Percent (160.3) NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION (A-88-WM-01) E78LM-1-AH Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	12/19/02

LOT # F2I130297

STL ST. LOUIS

PSL20300
Page 1

SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS530001XX DUP ✓
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-001-X
WORK ORDER: E78LM SMPDUP
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 12:15
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD	06	9/16/02	0/00/00	3/10/03
10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101				
(A-GM-0B-01) E78LM-1-AE Protocol: A				
QC Program: STANDARD TEST SET				

LOT # F2I130297

STL ST. LOUIS

PSL20300
Page 1

SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: TIERNEYB

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS540001XX
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-002
WORK ORDER: E78L4
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 12:45
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Iso THORIUM (LONG CT) NAS & DOE MOD	06	9/18/02	0/00/00	3/10/03
Sequential Actinides (Pu/Am/Th) by IEx and/or ExC				
(A-IK-18-01) E78L4-1-AC Protocol: A				
QC Program: STANDARD TEST SET				
Iso URANIUM (LONG CT) NAS & DOE MOD	06	9/18/02	0/00/00	3/10/03
Sequential Actinides (Pu/Am/Th) by IEx and/or ExC				
(A-IK-16-01) E78L4-1-AD Protocol: A				
QC Program: STANDARD TEST SET				
Gamma Ra-226 & Hits By HASL 300 MOD	06	9/13/02	0/00/00	3/10/03
10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101				
(A-GM-0B-01) E78L4-1-AA Protocol: A				
QC Program: STANDARD TEST SET				
Moisture, Percent (160.3)	06	9/18/02	0/00/00	12/19/02
NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION				
(A-88-WM-01) E78L4-1-AE Protocol: A				
QC Program: STANDARD TEST SET				

STL ST. LOUIS

PSL20300
Page 1

SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS550001XX
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-004
WORK ORDER: E78MC
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 14:30
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD 10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101 (A-GM-0B-01) E78MC-1-AA Protocol: A QC Program: STANDARD TEST SET	06	9/13/02	0/00/00	3/10/03
Iso THORIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-18-01) E78MC-1-AC Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Iso URANIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-16-01) E78MC-1-AD Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Moisture, Percent (160.3) NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION (A-88-WM-01) E78MC-1-AE Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	12/19/02

LOT # F2I130297

STL ST. LOUIS

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SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS560001XX
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-005
WORK ORDER: E78ME
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 14:50
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD 10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101 (A-GM-0B-01) E78ME-1-AA Protocol: A QC Program: STANDARD TEST SET	06	9/13/02	0/00/00	3/10/03
Iso THORIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-18-01) E78ME-1-AC Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Iso URANIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-16-01) E78ME-1-AD Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Moisture, Percent (160.3) NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION (A-88-WM-01) E78ME-1-AE Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	12/19/02

STL ST. LOUIS

PSL20300
Page 1

SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS560101XX
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-006
WORK ORDER: E78MG
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 15:00
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD 10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101 (A-GM-0B-01) E78MG-1-AA Protocol: A QC Program: STANDARD TEST SET	06	9/13/02	0/00/00	3/10/03
Iso THORIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-18-01) E78MG-1-AC Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Iso URANIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-16-01) E78MG-1-AD Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Moisture, Percent (160.3) NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION (A-88-WM-01) E78MG-1-AE Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	12/19/02

LOT # F2I130297

STL ST. LOUIS

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SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS560101XL
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-007
WORK ORDER: E78MJ
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 15:10
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD 10-DAY INGROWTH PREP RC0003 , RC0025 , CT-RD0101 (A-GM-0B-01) E78MJ-1-AA Protocol: A QC Program: STANDARD TEST SET	06	9/13/02	0/00/00	3/10/03
Iso THORIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-18-01) E78MJ-1-AF Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Iso URANIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-16-01) E78MJ-1-AG Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Moisture, Percent (160.3) NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION (A-88-WM-01) E78MJ-1-AH Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	12/19/02

LOT # F2I130297

STL ST. LOUIS

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SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS560101XL DUP
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-007-X
WORK ORDER: E78MJ SMPDUP
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 15:10
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

WRK	REQUEST	EXTRACTION	ANALYSIS
LOC	DATE	EXP DATE	EXP DATE

Gamma Ra-226 & Hits By HASL 300 MOD - -06	9/16/02	0/00/00	3/10/03
10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101			
(A-GM-0B-01) E78MJ-1-AE Protocol: A QC Program: STANDARD TEST SET			

LOT # F2I130297

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Page 1SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. LouisRun Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS570001XX
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-008
WORK ORDER: E78ML
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 15:15
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD 10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101 (A-GM-0B-01) E78ML-1-AA Protocol: A QC Program: STANDARD TEST SET	06	9/13/02	0/00/00	3/10/03
Iso THORIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-18-01) E78ML-1-AC Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Iso URANIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-16-01) E78ML-1-AD Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Moisture, Percent (160.3) NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION (A-88-WM-01) E78ML-1-AE Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	12/19/02

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SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS580001XX
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-009
WORK ORDER: E78MP
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 15:30
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD 10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101 (A-GM-0B-01) E78MP-1-AA Protocol: A QC Program: STANDARD TEST SET	06	9/13/02	0/00/00	3/10/03
Iso THORIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-18-01) E78MP-1-AC Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Iso URANIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-16-01) E78MP-1-AD Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Moisture, Percent (160.3) NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION (A-88-WM-01) E78MP-1-AE Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	12/19/02

LOT # F2I130297

STL ST. LOUIS

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SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS580001XD
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-010
WORK ORDER: E78MQ
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 15:30
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD 10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101 (A-GM-0B-01) E78MQ-1-AA Protocol: A QC Program: STANDARD TEST SET	06	9/13/02	0/00/00	3/10/03
Iso THORIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-18-01) E78MQ-1-AC Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Iso URANIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-16-01) E78MQ-1-AD Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Moisture, Percent (160.3) NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION (A-88-WM-01) E78MQ-1-AE Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	12/19/02

LOT # F2I130297

STL ST. LOUIS

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SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS580101XX
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-011
WORK ORDER: E78MT
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 15:40
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD 10-DAY INGROWTH PREP RC0003 , RC0025 CT RD0101 (A-GM-0B-01) E78MT-1-AA Protocol: A QC Program: STANDARD TEST SET	06	9/13/02	0/00/00	3/10/03
Iso THORIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-18-01) E78MT-1-AC Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Iso URANIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-16-01) E78MT-1-AD Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Moisture, Percent (160.3) NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION (A-88-WM-01) E78MT-1-AE Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	12/19/02

LOT # F2I130297

STL ST. LOUIS

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SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: TIERNEYB

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS580101XD
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-012
WORK ORDER: E78MW
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 15:40
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Iso THORIUM (LONG CT) NAS & DOE MOD	06	9/18/02	0/00/00	3/10/03
Sequential Actinides (Pu/Am/Th) by IEx and/or ExC				
(A-IK-18-01) E78MW-1-AC Protocol: A QC Program: STANDARD TEST SET				
Gamma Ra-226 & Hits By HASL 300 MOD	06	9/13/02	0/00/00	3/10/03
10-DAY INGROWTH PREP RC0003 , RC0025 , -CT RD0101				
(A-GM-0B-01) E78MW-1-AA Protocol: A QC Program: STANDARD TEST SET				
Iso URANIUM (LONG CT) NAS & DOE MOD	06	9/18/02	0/00/00	3/10/03
Sequential Actinides (Pu/Am/Th) by IEx and/or ExC				
(A-IK-16-01) E78MW-1-AD Protocol: A QC Program: STANDARD TEST SET				
Moisture, Percent (160.3)	06	9/18/02	0/00/00	12/19/02
NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION				
(A-88-WM-01) E78MW-1-AE Protocol: A QC Program: STANDARD TEST SET				

LOT # F2I130297

STL ST. LOUIS

PSL20300
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SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS590001XX
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-013
WORK ORDER: E78MX
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 17:00
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD 10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101 (A-GM-0B-01) E78MX-1-AA Protocol: A QC Program: STANDARD TEST SET	06	9/13/02	0/00/00	3/10/03
Iso THORIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-18-01) E78MX-1-AC Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Iso URANIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-16-01) E78MX-1-AD Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Moisture, Percent (160.3) NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION (A-88-WM-01) E78MX-1-AE Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	12/19/02

STL ST. LOUIS

PSL20300
Page 1

SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: TIERNEYB

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS600001XX
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-014
WORK ORDER: E78M1
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 17:10
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Iso THORIUM (LONG CT) NAS & DOE MOD	06	9/18/02	0/00/00	3/10/03
Sequential Actinides (Pu/Am/Th) by IEx and/or ExC				
(A-IK-18-01) E78M1-1-AC Protocol: A		QC Program:	STANDARD TEST SET	
Iso URANIUM (LONG CT) NAS & DOE MOD	- 06	9/18/02	0/00/00	3/10/03
Sequential Actinides (Pu/Am/Th) by IEx and/or ExC				
(A-IK-16-01) E78M1-1-AD Protocol: A		QC Program:	STANDARD TEST SET	
Gamma Ra-226 & Hits By HASL 300 MOD	06	9/13/02	0/00/00	3/10/03
10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101				
(A-GM-0B-01) E78M1-1-AA Protocol: A		QC Program:	STANDARD TEST SET	
Moisture, Percent (160.3)	06	9/18/02	0/00/00	12/19/02
NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION				
(A-88-WM-01) E78M1-1-AE Protocol: A		QC Program:	STANDARD TEST SET	

PSL20300
Page 1SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. LouisRun Date: 9/18/02
Time: 8:54:25
User Id.: QPGMR

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: RAD
LOT COMMENTS:
MATRIX: SOLID
USAF MATRIX:
SAMPLE ID: SS590101XX
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-015
WORK ORDER: E78M3
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/11/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 17:30
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

	WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
Gamma Ra-226 & Hits By HASL 300 MOD 10-DAY INGROWTH PREP RC0003 , RC0025 , CT RD0101 (A-GM-0B-01) E78M3-1-AA Protocol: A QC Program: STANDARD TEST SET	06	9/13/02	0/00/00	3/10/03
Iso THORIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-18-01) E78M3-1-AC Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Iso URANIUM (LONG CT) NAS & DOE MOD Sequential Actinides (Pu/Am/Th) by IEx and/or ExC (A-IK-16-01) E78M3-1-AD Protocol: A QC Program: STANDARD TEST SET	06	9/18/02	0/00/00	3/10/03
Moisture, Percent (160.3) NO SAMPLE PREPARATION PERFORMED / DIRECT INJECTION (A-88-WM-01) E78M3-1-AE Protocol: A QC Program: STANDARD TEST SET	-06	9/18/02	0/00/00	12/19/02

STL ST. LOUIS

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SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: ZAHNRM

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: METALS
LOT COMMENTS:
MATRIX: WATER
USAF MATRIX:
SAMPLE ID: B250702XX ~
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-016
WORK ORDER: E78M4
RECEIVING DATE: 9/13/02~
SAMPLING DATE: 9/12/02~
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 11:00~
RECEIVING TIME: 9:40~

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

Inductively Coupled Plasma (6010B)
METALS, TOTAL - Waters
M6010_L PB
(I-05-QO-01) E78M4

WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
06	9/13/02	0/00/00	3/11/03

Protocol: A QC Program: STANDARD TEST SET

STL ST. LOUIS

PSL20300
Page 1

SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:25
User Id.: ZAHNERM

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: METALS
LOT COMMENTS:
MATRIX: WATER
USAF MATRIX:
SAMPLE ID: B250702XF
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-017
WORK ORDER: E78P3
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/12/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 11:00
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

Inductively Coupled Plasma (6010B)
METALS, TOTAL - Waters
M6010_L PB
(I-05-QO-01) E78P3

WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
06	9/13/02	0/00/00	3/11/03

Protocol: A QC Program: STANDARD TEST SET

STL ST. LOUIS

PSL20300
Page 1

SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:26
User Id.: ZAHNERM

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: METALS
LOT COMMENTS:
MATRIX: WATER
USAF MATRIX:
SAMPLE ID: B310702XX
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-018
WORK ORDER: E78P4
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/12/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 12:25
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

Inductively Coupled Plasma (6010B)
METALS, TOTAL - Waters
M6010_L PB
(I-05-QO-01) E78P4

WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
06	9/13/02	0/00/00	3/11/03

Protocol: A QC Program: STANDARD TEST SET

STL ST. LOUIS

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SEVERN TRENT LABORATORIES, INC
CLIENT ANALYSIS SUMMARY
STL St. Louis

Run Date: 9/18/02
Time: 8:54:26
User Id.: ZAHNERM

CLIENT: 63000 HARDING ESE
PROJECT MANAGER: Billy Tierney
PROJECT #:
REPORT TO: Mark Salvetti
P.O. NUMBER:
SITE: Boston Army Arsenal
AMOUNT REC'D: 500P
STORAGE LOC: METALS
LOT COMMENTS:
MATRIX: WATER
USAF MATRIX:
SAMPLE ID: B310702XF
QC PACKAGE: Report
SAMPLE COMMENTS:

QUOTE/SAR #: 49506
LAB ID: F-2I130297-019
WORK ORDER: E78P7
RECEIVING DATE: 9/13/02
SAMPLING DATE: 9/12/02
ANALYTICAL DUE DATE: 10/10/02N
REPORT DUE DATE: 10/11/02
PRIORITY: 27
SAMPLING TIME: 12:25
RECEIVING TIME: 9:40

SDG# :

Beginning Depth: .00 Ending Depth: .00

***** ANALYSIS *****

Inductively Coupled Plasma (6010B)
METALS, TOTAL - Waters
M6010_L PB
(I-05-QO-01) E78P7

WRK LOC	REQUEST DATE	EXTRACTION EXP DATE	ANALYSIS EXP DATE
06	9/13/02	0/00/00	3/11/03

Protocol: A QC Program: STANDARD TEST SET

Chain of Custody Record

SEVERN
TRENT
SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client HARDING ESE		Project Manager MARK SALVETTI		Date 9/12/02	Chain of Custody Number 147803
Address 107 AUDUBON RD #301		Telephone Number (Area Code)/Fax Number 781-245-6606 / 781-246-5060		Lab Number	Page 1 of 2

City WAKEFIELD	State MA	Zip Code 01880	Site Contact	Lab Contact	Analysis (Attach list if more space is needed)	Special Instructions/ Conditions of Receipt
Project Name and Location (State) GSA WATERTOWN MA			Carrier/Waybill Number			
Contract/Purchase Order/Quote No. 11052			Matrix	Containers & Preservatives		

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Soil	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc2	NaOH	Gamma SPEC	Alpha SPEC
SS530001XX	9/11/02	1215			X		X							X	X
SS540001XX	9/11/02	1245			X		X							X	X
SS54001XX	9/11/02	1415			X		X							X	X
SS550001XX	9/11/02	1430			X		X							X	X
SS560001XX	9/11/02	1450			X		X							X	X
SS560101XX	9/11/02	1500			X		X							X	X
SS560101XL	9/11/02	1510			X		X							X	X
SS570001XX	9/11/02	1515			X		X							X	X
SS580001XX	9/11/02	1530			X		X							X	X
SS580001XD	9/11/02	1530			X		X							X	X
SS580101XX	9/11/02	1540			X		X							X	X
SS580101XD	9/11/02	1540			X		X							X	X

Possible Hazard Identification	Sample Disposal	(A fee may be assessed if samples are retained longer than 1 month)
<input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown	<input type="checkbox"/> Return To Client <input checked="" type="checkbox"/> Disposal By Lab <input type="checkbox"/> Archive For _____ Months	

Turn Around Time Required	QC Requirements (Specify)
<input type="checkbox"/> 24 Hours <input type="checkbox"/> 48 Hours <input type="checkbox"/> 7 Days <input type="checkbox"/> 14 Days <input type="checkbox"/> 21 Days <input type="checkbox"/> Other _____	

1. Relinquished By 	Date 9/12/02	Time 1400	1. Received By 	Date 9-13-02	Time 9:10
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments: **GAMMA SPEC - U, Th, Ra series, 2-sigma = 0.5 pCi/g per gamma emitting isotope**
ALPHA SPEC - U, Th series, 2-sigma = 0.1 pCi/g per alpha emitting isotope

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

PLEASE SEE ATTACHED LABEL

Chain of Custody Record

SEVERN
TRENT
SERVICES

Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client HARDING ESE		Project Manager MARK SALVETTI		Date 9/12/02	Chain of Custody Number 147805
Address 107 AUDUBON RD #301		Telephone Number (Area Code)/Fax Number 781-245-6606 / 781-246-5060		Lab Number	Page 2 of 2

City WAKEFIELD	State MA	Zip Code 01880	Site Contact	Lab Contact	Analysis (Attach list if more space is needed)										Special Instructions/ Conditions of Receipt				
Project Name and Location (State) WATERTOWN GSA (MA)			Carrier/Waybill Number																
Contract/Purchase Order/Quote No. 11052			Matrix		Containers & Preservatives														
Sample I.D. No. and Description (Containers for each sample may be combined on one line)			Date	Time	Air	Aqueous	Sed.	Soil	Unpres.	H ₂ SO ₄	HNO ₃	HCl	NaOH	ZnAc ₂		NaOH	ALPHA SPEC	GAMMA SPEC	LEAD
SS590001XX			9/11/02	1700				X	X							X	X		500 p ↓ 500 p ↓
SS600001XX			9/11/02	1710				X	X							X	X		
SS590101XX			9/11/02	1730				X	X							X	X		
B250702XX			9/12/02	1100		X					X						X		
B250702XF			9/12/02	1100		X					X						X		
B310702XX			9/12/02	1225		X					X						X		
B310702XF			9/12/02	1225		X					X						X		

Possible Hazard Identification		Sample Disposal		(A fee may be assessed if samples are retained longer than 1 month)	
<input checked="" type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown		<input type="checkbox"/> Return To Client <input checked="" type="checkbox"/> Disposal By Lab <input type="checkbox"/> Archive For _____ Months			
Turn Around Time Required		QC Requirements (Specify)			
<input type="checkbox"/> 24 Hours <input type="checkbox"/> 48 Hours <input type="checkbox"/> 7 Days <input type="checkbox"/> 14 Days <input type="checkbox"/> 21 Days <input type="checkbox"/> Other _____					
1. Relinquished By		Date 9/12/02	Time 1400	1. Received By	
2. Relinquished By		Date	Time	2. Received By	
3. Relinquished By		Date	Time	3. Received By	

Comments: **Gamma spec for U, Th, Ra series, 2-sigma 0.5 pCi/g per gamma emitting isotope**
Gamma spec for U, Th series, 2-sigma 0.1 pCi/g per alpha emitting isotope

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

P1 CASE SEE ATTACHED SHEET

LIMITED QUANTITY STATEMENT

**“This package conforms to
the conditions and limitations
specified in 49 CFR 173.421
for radioactive material,
excepted package – limited
quantity of material,
UN2910”**

PROCEDURE NO: RPP-24	REVISION NO: 0	ATTACHMENT 3 PAGE NO: 1 OF 1
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LIMITED QUANTITY STATEMENT

**“This package conforms to
the conditions and limitations
specified in 49 CFR 173.421
for radioactive material,
excepted package – limited
quantity of material,
UN2910”**

PROCEDURE NO: RPP-24	REVISION NO: 0	ATTACHMENT 3 PAGE NO: 1 OF 1
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Harding ESE PO 11052

**Watertown GSA
Radiological Analysis of Soil Samples
Site-Specific Requirements**

These notes represent a summary of items discussed during a conference call between Jeff Lively of MACTEC, Mark Salvetti of Harding ESE, and Joel Kempema and Mitch Abbate of STL on June 12, 2002.

Soil to be analyzed by gamma spectroscopy for uranium, thorium, and radium series.
Soil to be analyzed by alpha spectroscopy for uranium and thorium series.

Detection level (2-sigma) will be 0.5 pCi/g per significant gamma emitting isotope.
Detection level (2-sigma) will be 0.1 pCi/g per significant alpha emitting isotope.

1. Soil has been field sieved and the fine fraction packed into Marinelli containers. Containers have been sealed and are to remain sealed for a 10-day ingrowth period prior to gamma spectroscopy analysis. Samples are not to be dried or milled prior to gamma spec analysis.

If the sieved coarse fraction exhibited a field gross gamma greater than the fine fraction, then the coarse fraction will have been placed in a 500 ml glass jar and also submitted to STL for gamma spec.

2. After gamma spec analysis has been completed, the Marinelli containers are to be opened and the percent moisture shall be determined. The entire contents shall then be milled and prepared for alpha spec analysis.

Any coarse fraction that may have been submitted for gamma spec in a glass jar will be similarly prepared; i.e. the entire contents shall be dried and milled for alpha spec analysis.

Points of Contact if Questions:

Jeff Lively (MACTEC; Grand Junction, CO): (970) 243-2861; Mobile: (970) 260-8202
Mark Salvetti (Harding ESE; Wakefield, MA): (781) 213-5652



Condition Upon Receipt Form
St. Louis Laboratory

Lot No.: F2I130297
MMZ
9/13/02 F2I130297

Client: US Army Corps of Eng.
Quote No: 49506
Shipper/No: Fed X 836524145150

Date: 9-13-02 Time: 8:10
Initiated by: JW
COC/RFA Numbers: _____

Condition/Variance (Circle "Y" for yes and "N" for no. If "N" is circled, see notes for explanation):

1. <input checked="" type="radio"/> N	Sample received in undamaged condition.	5. <input checked="" type="radio"/> N	Sample volume sufficient for analysis.
2. <input type="radio"/> Y <input type="radio"/> N	Sample received within $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ *	6. <input checked="" type="radio"/> Y <input type="radio"/> N	Sample received with Chain of Custody.
	Record temperature: <u>9.0</u>	7. <input checked="" type="radio"/> Y <input type="radio"/> N	Chain of Custody matches sample IDs on containers.
3. <input type="radio"/> Y <input checked="" type="radio"/> N <input checked="" type="radio"/> N/A	Sample received with proper pH**.	8. <input type="radio"/> Y <input checked="" type="radio"/> N	Custody seal received intact and tamper evident on cooler.
4. <input checked="" type="radio"/> Y <input type="radio"/> N	Sample received in proper containers.	9. <input type="radio"/> Y <input checked="" type="radio"/> N	Custody seal received intact and tamper evident on bottles.

* Temperature Variance Does Not Affect the Following Analyses: _____

** For DOE-AL (Pantex, LANL, Sandia, Timet) sites, remember to pH all containers received, except for VOA, TOX, and soils.

Notes:

Corrective Action:

- ☐ Client's Name: _____ Informed verbally on: _____ By: _____
- ☐ Client's Name: _____ Informed in writing on: _____ By: _____
- ☐ Sample(s) processed "as is".
- ☐ Sample(s) on hold until: _____ If released, notify: _____

Sample Control Supervisor (or designate) Review: [Signature] Date: 9-13-02

Project Management Review: [Signature] Date: 9-17-02

SIGNED ORIGINAL MUST BE RETAINED IN THE PROJECT FILE
THIS FORM MUST BE COMPLETED AT THE TIME THE ITEMS ARE BEING CHECKED
IF ANY ITEM IS COMPLETED BY SOMEONE OTHER THAN THE INITIATOR, THEN THAT PERSON IS REQUIRED TO APPLY THEIR
INITIALS AND THE DATE NEXT TO THAT ITEM

APPENDIX C
PHOTOGRAPHS



Staked location 1-S95 prior to brush clearing activities.



Brush clearing activities looking across cleared sampling area FS-07 towards FS-01.

Harding ESE, Inc.



Cleared 20' x 20' sampling Area of 1-S92 prior to flagged grid system.



Sampling area 1-S92 with pin flagged grid system.

Harding ESE, Inc.

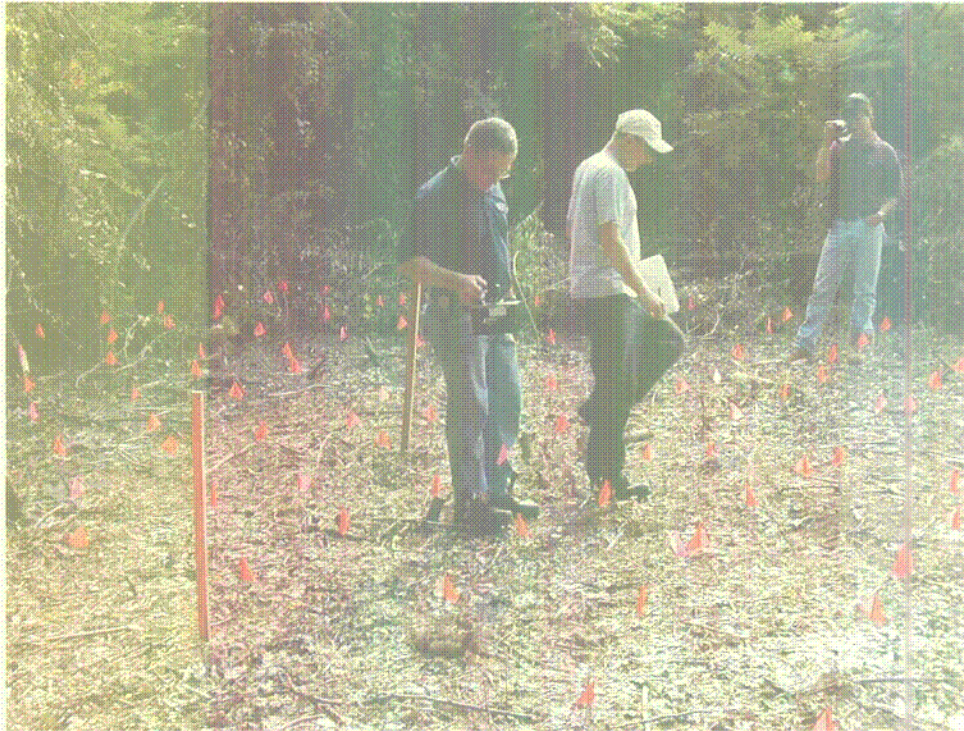


Flagging in area of 1-S95.



Decontamination area with sampling grid FS-07 in the foreground.

Harding ESE, Inc.



Harding ESE operating the Bicorn Micro Rem C607J for the measurement of general area radiation levels.



Harding ESE conducting the gross gamma scan of the surface soil within FS-01 sampling area.

Harding ESE, Inc.



MADEP performing gross gamma scan of 1-S95 sampling area with MACTEC's Health Physicist's oversight.

Timed direct static measurements using the sodium iodide probe.



Harding ESE, Inc.



Close up of a timed direct static measurement using the sodium iodide probe at a grid node.



**Stainless steel bucket auger implemented for the collection of the surface soil samples.
Boots and gloves were donned during intrusive soil sampling activities.**

Harding ESE, Inc.



Surface soil collection through No. 10 sieve into a stainless steel bowl.



Collection of soil samples through a No. 10 sieve into a stainless steel bowl.

Harding ESE, Inc.

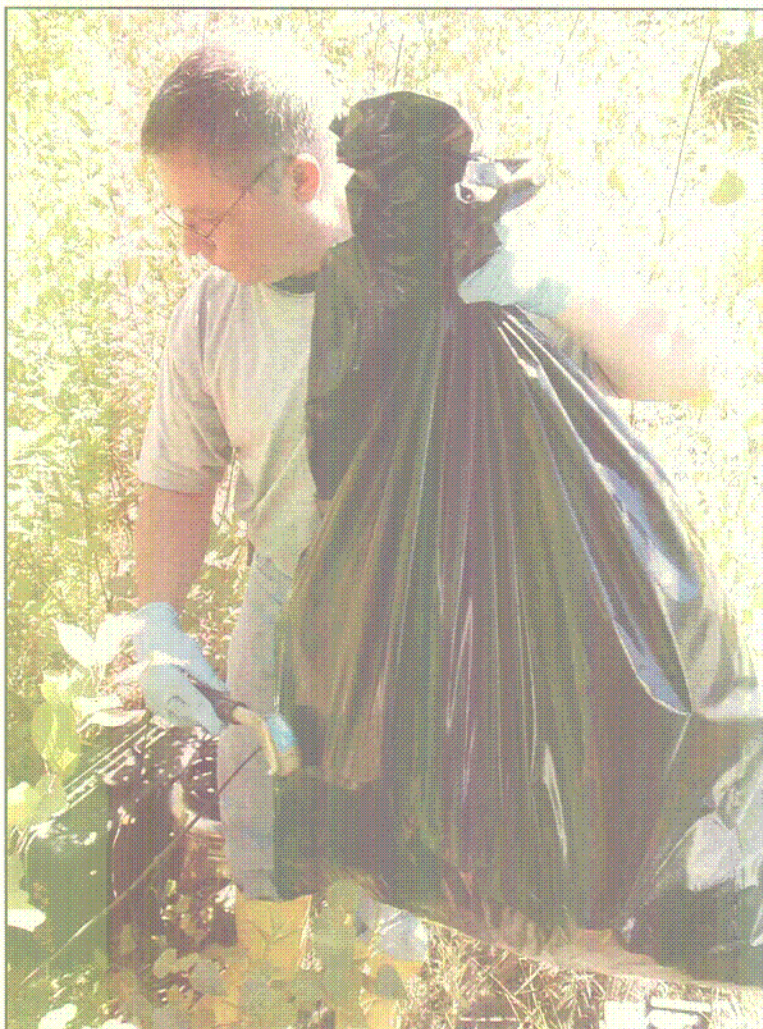


Sieved fraction of soil being packed into a marinelli jar to be sent offsite for analysis.



MACTEC's health physicist scanning disposable boots post intrusive soil sampling activities.

Harding ESE, Inc.



Scanning PPE waste bag with the Ludlum Model 12 prior to disposal.