2000 Interior House Dust
Data Summary Report

TerraGraphics
ENVIRONMENTAL ENGINEERING, INC

2000 Interior House Dust
Data Summary Report

Prepared for:
Department of Environmental Quality
Boise, Idaho

Prepared by:
TerraGraphics Environmental Engineering, Inc.
121 South Jackson, Moscow, Idaho 83843
(208) 882-7858

April 2001

Table of Contents

List of Figures

List of Tables

SECTION 1.0 INTRODUCTION

1.1 Background

The Bunker Hill Superfund Site (BHSS) is located in Shoshone County in northern Idaho, nearly 40 miles east of Coeur d'Alene, Idaho. The site encompasses approximately 21 square miles in the Silver Valley of the South Fork of the Coeur d'Alene River (SFCDR) (Figure 1). The site is home to more than 7000 people in five residential areas or communities, including the cities of Kellogg, Wardner, Smelterville, Pinehurst, and the unincorporated communities of Page, Ross Ranch, Elizabeth Park, and part of Montgomery Gulch (Figure 2). Superfund activities were initiated under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) following findings of widespread lead poisoning among local children in the late 1970s. Cleanup activities and public health intervention have been underway since the smelter closure in 1981. The Project was initiated in 1983 and is in its seventeenth year. Remedial Investigation and Feasibility Studies (RI/FS) were completed in 1992 and Records of Decision (RODs) were entered in 1991 for the Populated Areas of the site (USEPA 1991) and in 1992 for the Non-populated Areas (USEPA 1992).

The cleanup strategy was based on site-specific analyses of the relationship between observed blood lead absorption among children and environmental media lead concentrations at the site. The BHSS was the first site to use the U.S. Environmental Protection Agency (USEPA) Integrated Exposure Uptake Bio-kinetic Model (IEUBK) for lead in formulating cleanup criteria for lead in soils and dusts.

The site-wide Remedial Action Objectives (RAOs) are defined in the two RODs. With respect to childhood lead absorption, RAOs are to reduce the incidence of lead poisoning in each community to:

- less than 5% of children with blood lead levels of 10 μg/dl or greater; and
- no individual child exceeding 15 μg/dl (nominally, <1% of the population).

These objectives are to be achieved by a strategy that includes:

- remediation of all yards, commercial properties, and rights-of-way (ROWs) that have lead concentrations greater than 1000 mg/kg;
- achieving a geometric mean yard soil lead concentration of less than 350 mg/kg for each community in the site;
- controlling fugitive dust and stabilizing and covering contaminated soils throughout the site; and
- achieving geometric mean interior house dust lead levels for each community of 500 mg/kg or less, with no individual house dust lead level exceeding 1000 mg/kg.

Remedial actions in the Populated Areas of the site have focused on soils. Specific remedies for contaminated soils within the site depend on levels of contamination and current or projected use of a given area. Remediation of contaminated residential soils within the site does not focus on complete removal of contaminated soils from yards, but rather on creating a barrier between the contaminants and the residents. The ROD states that the Institutional Controls Program (ICP) will guide the establishment of effective barriers in areas where lead concentrations exceed 1000 mg/kg in surficial soils. The RAOs are used to drive the yard soil cleanup, which is currently in progress in the Populated Areas of the site, and will continue to apply to new development in the site. The remedy is paid for by the Potentially Responsible Parties (PRPs) in currently established residential areas, and will be applied as part of development with the help of State in-kind services for new developments.

House dust has long been recognized as a primary source of lead intake and excess absorption among children in numerous populations. House dusts are the predominant source of lead exposure for young children at the BHSS. Site specific dose-response analyses, conducted to support the ROD, suggest that the ultimate success of the overall remedial strategy depends on reducing interior dust lead concentrations to levels comparable to post-remedial area soils. If house dust lead concentrations remain elevated as yard soil removals continue, an interior remediation strategy for the site will be implemented (TerraGraphics 1990, CH2M Hill 1991).

Actions conducted to assist in meeting the house dust RAO include fugitive dust stabilization and elimination of soil sources. House dust lead exposures decreased remarkably, from about 10,000 mg/kg in 1974 to about 4000 mg/kg in 1975, in response to air pollution control initiatives at the smelter. By 1983, house dust lead exposures in Kellogg and Smelterville both averaged approximately 3000 mg/kg and were primarily dependent on soil sources. Following Fast Track removals and fugitive dust control efforts from 1985-1987, house dust lead exposures had decreased by about 50% to approximately 1500 mg/kg in Kellogg and 1200 mg/kg in Smelterville. Continued reductions in house dust lead exposures have been noted since 1990 and geometric mean dust lead exposures in Smelterville and Kellogg in 1999 ranged between approximately 460 mg/kg and 620 mg/kg (TerraGraphics 2000a, 2000d). 1999 geometric mean concentrations are reported in the *1999 Interior House Dust Data Summary Report* (TerraGraphics 2000b).

Until 1997, house dust data were primarily collected from homes of children participating in the annual blood lead survey. Using children's presence in the home as a selection criteria for dust sampling provided a measure of house dust exposure that could be related to observed blood lead levels. Annual blood lead samples have typically been obtained for more than 60% of children identified in the community and house dust samples have been obtained for about half of the children participating. However, the information may not be representative of dust lead concentrations at other homes in the overall community. Both dust lead concentrations and dust loading may differ in homes where children do not reside due to behavioral factors or because the yards in homes occupied by children were preferentially remediated earlier in the cleanup program.

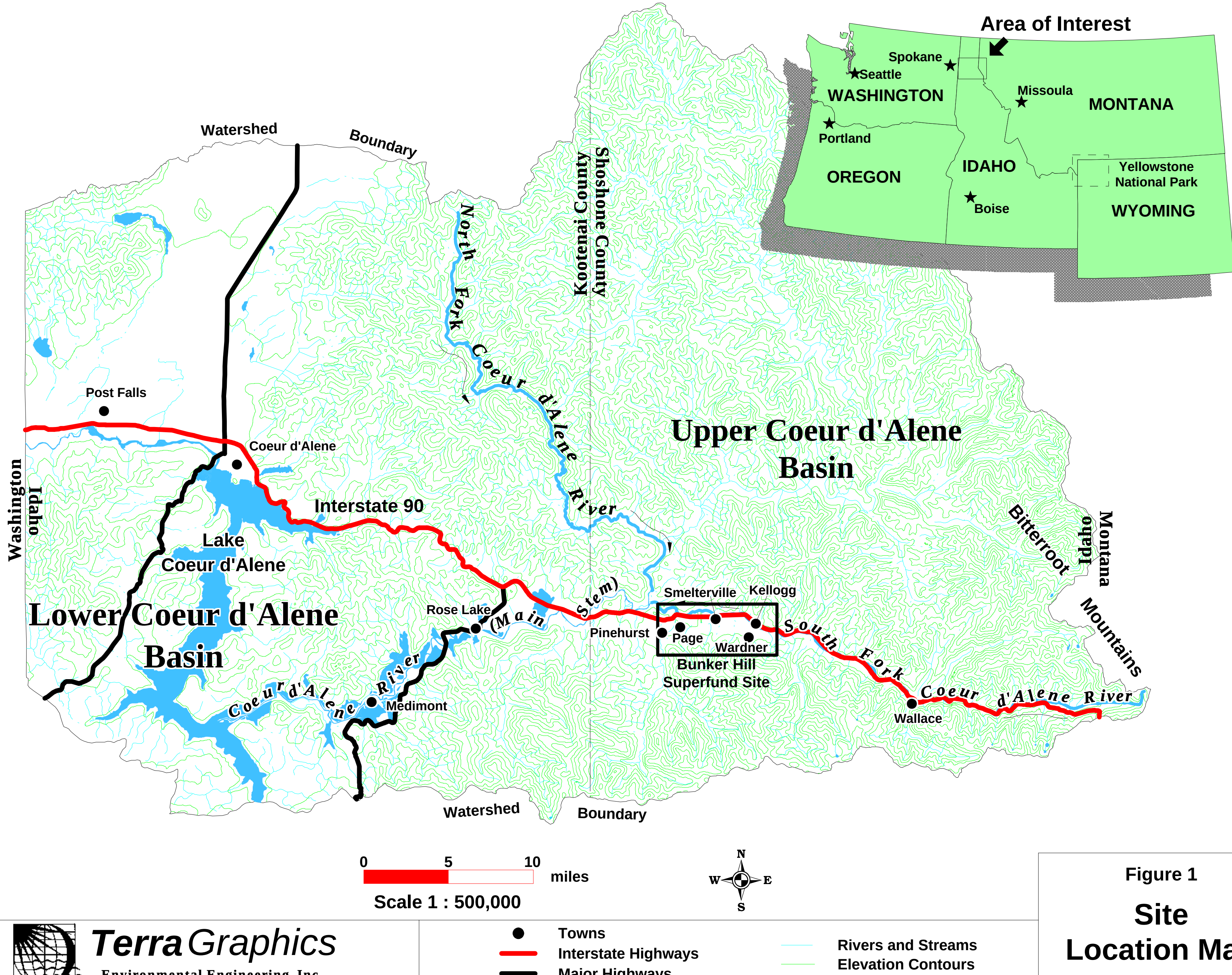
1.2 Purpose and Objectives

Under the direction of the USEPA and Idaho's Department of Environmental Quality (DEQ), TerraGraphics performed site-wide house dust sampling throughout Kellogg, Page, Pinehurst, Smelterville, and Wardner in July and August 2000, collecting vacuum dust and mat dust samples from as many homes as feasible within the allocated budget. The objectives of the survey are to:

- monitor trends in house dust lead concentrations;
- evaluate floor mats as a method of monitoring dust and lead loading rates;
- determine whether a quantifiable relationship exists between lead concentrations in dust mat and vacuum bag samples;
- assess the usefulness of interior dust sampling methods in exposure assessments, identification of sources, and evaluation of remediation effectiveness; and
- determine the need for interior remediation and/or public health follow-up activities at individual homes.

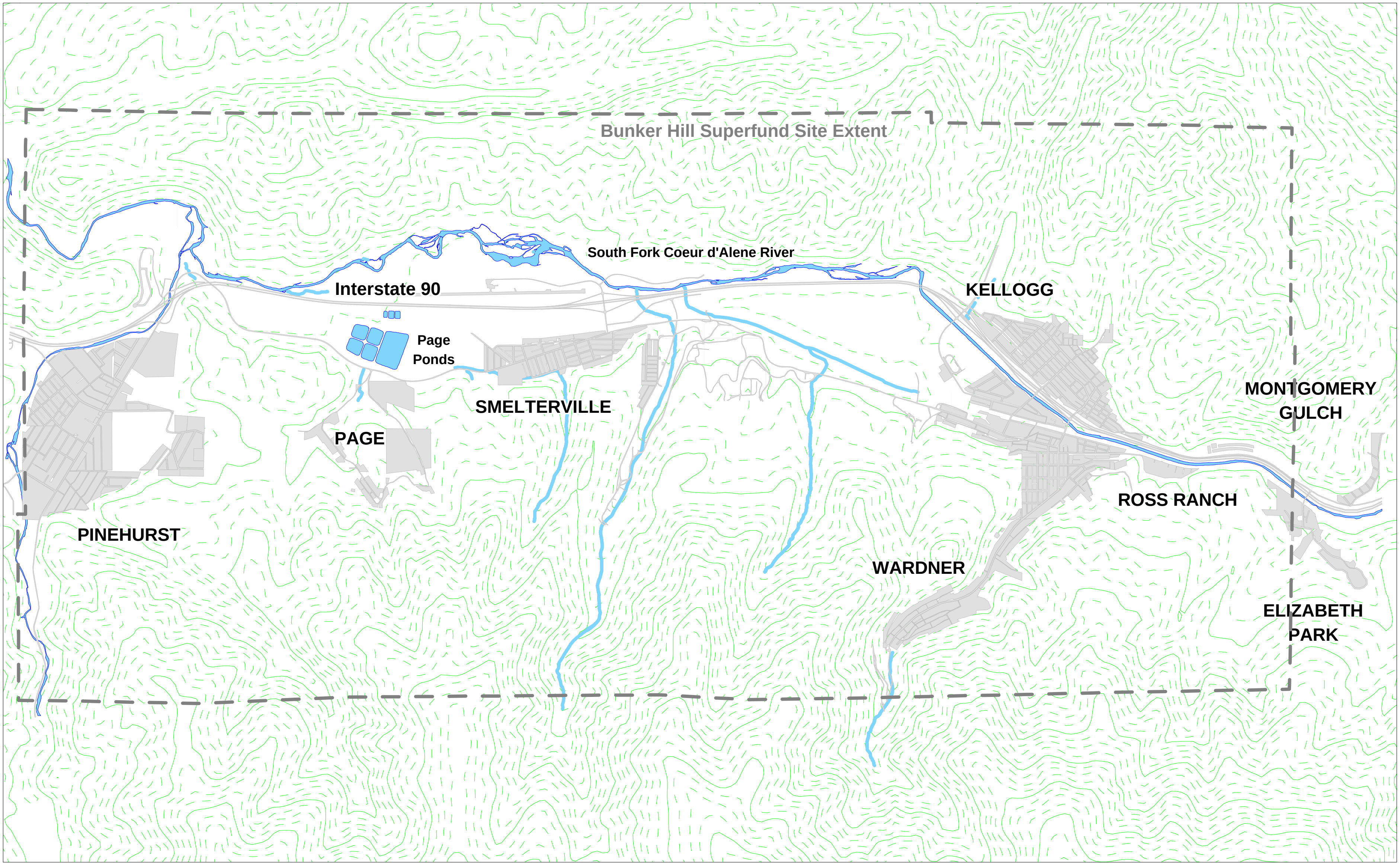
This house dust survey is part of a three phase project that includes evaluation of hillsides, ROWs, and house dusts; its primary purpose is to provide information regarding lead exposure due to potential re-contamination of soils and dusts in the Populated Areas. The data will also be used to evaluate the effectiveness of the ICP in preventing re-contamination and to ensure that the PRPs have fulfilled their cleanup obligations under the Consent Decree.

This report is intended to combine and summarize raw data and quality assurance/quality control (QA/QC) findings from the two separate 2000 interior dust sampling events. One event, implemented by the Panhandle Health District (PHD), included homes in Kellogg, Page, Pinehurst, Smelterville, and Wardner where children live and who participated in the 2000 Lead Health Intervention Program (LHIP). The site-wide sampling event focused on a broad based approach in Kellogg, Page, Pinehurst, Smelterville, and Wardner. Houses sampled in the site-wide survey may or may not have had children present. Sampling protocols, used for the two sampling events, are described in detail in the *2000 FINAL Field Work Plan for Interior Dust Sampling* (TerraGraphics 2000c). An in-depth data analysis and interpretation of data collected at the BHSS through 1998 are presented in the *1999 Five Year Review Report for the Bunker Hill Superfund Site* for the populated areas (TerraGraphics 2000a), which focuses on the relationship between soils, dusts, and blood lead levels, as well as issues concerning RAOs and re-contamination of the Populated Areas at the site. The Five Year Review report also discusses other data from previous interior dust, ROW, and hillsides sampling events.



TerraGraphics
Environmental Engineering, Inc.

Figure 1
Site Location Map



0 0.5 1.0 miles

Scale 1 : 50,000

N W E S

Main Roads

Topography

Figure 2

Bunker Hill Superfund Site

***Terra**Graphics*

Environmental Engineering, Inc.

SECTION 2.0 HOUSE DUST INVESTIGATIONS

2.1 Background

House dust lead concentrations have been monitored in home vacuum cleaner bags at the BHSS since the 1970s, and these data have been used in dose-response analyses relating blood and environmental media lead levels. The RAOs for the site were developed using these data, and subsequent analyses have indicated that, on a community basis, home vacuum bag lead concentrations are a useful indicator of exposure and remedial effectiveness. However, this variable is of limited usefulness in assessing individual situations because it provides little information regarding home dustiness or lead loading. Similarly, there is concern regarding the utility of this technique in assessing compliance with the house dust RAOs and for identifying the need for interior remediation.

As a result, the PHD and the DEQ, in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR) and the USEPA, began developing a new sampling technique that measured both lead concentration and lead loading rate at homes in the site and in the greater Coeur d'Alene River Basin. This method uses carpeted floor mats that are placed in the home for some number of weeks, with instructions that the mats not be disturbed or cleaned. The mats are then collected and vacuumed in a controlled dust laboratory at the University of Idaho. Dust collected from the mats is analyzed for lead in a laboratory, and the lead concentration, total dust, total lead, dust loadings and lead loadings are calculated. This information will be used to help evaluate compliance with the site's house dust related RAOs. This technique was first used in the 1996 Coeur d'Alene River Basin Environmental Health Exposure Assessment, and has since been applied at the site in conjunction with the 1997, 1998, 1999, and 2000 annual blood lead surveys conducted by the PHD and in other site-wide surveys conducted in the fall of 1997 in Smelterville, and in 1998 and 1999 interior house dust investigations in Kellogg and Smelterville. In 2000, interior house dust investigations took place in Kellogg, Page, Pinehurst, Smelterville, and Wardner.

2.2 Summary of Previous House Dust Investigations

Data from 1997, 1998, and 1999 house dust investigations summarized in this section were reported in the *1997 Interior House Dust and Smelterville Rights of Way Data Summary Report* (TerraGraphics 1999a), the *1998 Interior House Dust Data Summary Report* (TerraGraphics 1999b), and the *1999 Interior House Dust Data Summary Report* (TerraGraphics 2000b), respectively. The 1997 and 1998 results were also collectively summarized and analyzed in the Five Year Review (TerraGraphics 2000a).

2.2.1 1997 House Dust Survey

In the summer of 1997, a total of 129 dust mat samples were collected by PHD. Data analysis was performed on only 102 of these samples, because there was a concern that improper sample handling reduced data quality for 27 of these mats, which were subsequently rejected. PHD mat samples were collected from homes throughout the site where children resided and blood lead samples had recently been obtained. These mats remained in place an average of 47 days and were subsequently collected and vacuumed. Dust vacuumed from the mats was analyzed for lead in the laboratory. Individual lead concentrations in mat dusts ranged from 200 mg/kg to 8200 mg/kg. The arithmetic mean mat dust lead concentration was 1678 mg/kg, with a geometric mean of 1208 mg/kg. An average of 10.9 g of dust and 16.9 mg of lead was found on the mats site-wide. Lead loading rates ranged from 0.05 mg/m^2/day to 6.66 mg/m^2/day, with an arithmetic mean of 1.16 mg/m^2/day and a geometric mean of 0.57 mg/m^2/day.

That same year, 64 vacuum bag dust samples from many of the same homes where mats were placed, were collected by PHD and subsequently analyzed. Individual lead concentrations ranged from 43 mg/kg to 15,000 mg/kg, with a site-wide arithmetic mean of 898 mg/kg and a geometric mean of 474 mg/kg.

During the fall of 1997, a second site-wide dust mat and vacuum bag sampling effort was conducted with the goal of evaluating progress towards the house dust RAO in Smelterville. The same methods were used as in the PHD Survey; however, the mats were placed in *all* cooperating homes in the town, not just those with children participating in the blood lead surveys. As a result, this was the first time in nearly two decades of investigation that dust samples were collected from homes other than those where children with tested blood lead levels resided. A total of 187 dust mats were placed by sampling teams in October, and 181 mats were successfully recovered after remaining at their locations for an average of 21 days. The arithmetic mean lead concentration was 1008 mg/kg, with a geomteric mean of 808 mg/kg. An average of 6.1 g of dust and 6.8 mg of lead was collected from the mats. Lead loading rates ranged from 0.01 mg/m^2/day to 26.3 mg/m^2/day, with an arithmetic mean of 1.02 mg/m^2/day and a geometric mean of 0.42 mg/m^2/day.

The site-wide survey also sampled household dust by collecting dust from the residence's vacuum cleaner bag. An attempt was made to obtain a household dust sample at every residence visited during the survey. In the past, these dust samples have been used to represent dust exposure only to individuals inside the home. As a result, prior to sample collection, the sampler verified that the vacuum had not been used anywhere outside the home since the bag was last changed. A total of 115 vacuum bag grab samples were collected from homes in Smelterville. Lead concentrations ranged from 50 mg/kg to 9570 mg/kg, with an arithmetic mean of 1136 mg/kg and a geometric mean of 751 mg/kg.

2.2.2 1998 House Dust Survey

During PHD's annual blood lead survey of children in the summer of 1998, 211 dust mats were collected and subsequently vacuumed and analyzed for lead. Of the dust mats collected, 209 were included in the dust and lead loading portion of the analysis. These mats were placed at homes and remained for an average of 28 days. Individual lead concentrations in mat dusts ranged from 120 mg/kg in Pinehurst to 15,900 mg/kg in Kellogg. The arithmetic mean mat dust lead concentration was 1133 mg/kg with a geometric mean of 805 mg/kg. An average of 7.8 g of dust and 8.1 mg of lead was found on the mats site-wide. The lead loading rate ranged from 0.02 mg/m^2/day to 16.9 mg/m^2/day, with an arithmetic mean of 0.9 mg/m^2/day and a geometric mean of 0.4 mg/m^2/day.

As part of the 1998 PHD house dust sampling effort, 112 vacuum bag samples were analyzed for lead. These vacuum bag samples were collected from the same homes where mats were also placed. Individual lead concentrations ranged from 71 mg/kg in Pinehurst to 6000 mg/kg in Wardner. The site-wide arithmetic mean concentration was 732 mg/kg with a geometric mean lead concentration of 530 mg/kg.

In the summer of 1998, a second annual site-wide interior dust sampling event was conducted, which included both vacuum bag and dust mat sampling in both Smelterville and Kellogg. Dust mats and vacuum samples were again collected in all cooperating homes in Smelterville and approximately 1 in 4 homes in Kellogg. A total of 276 mats were collected, vacuumed, and analyzed for lead and loading. Mats remained in homes for an average of 31 days in Kellogg and 45 days in Smelterville. Kellogg mats exhibited lead concentrations ranging from 43 mg/kg to 35,600 mg/kg, and had an arithmetic mean of 1922 mg/kg with a geometric mean of 1200 mg/kg. An average of 3.7 g of dust and 11.4 mg of lead was collected from each Kellogg mat. The lead loading rate for Kellogg ranged from 0.01 mg/m^2/day to 51.2 mg/m^2/day, with an arithmetic mean of 1.1 mg/m^2/day and a geometric mean of 0.3 mg/m^2/day. Smelterville mat lead concentrations ranged from 224 mg/kg to 2660 mg/kg, and had an arithmetic mean of 1072 mg/kg and a geometric mean of 925 mg/kg. An average of 6.5 g of dust and 6.2 mg of lead was collected from each mat. Lead loading rates for Smelterville ranged from 0.03 mg/m^2/day to 2.7 mg/m^2/day, with an arithmetic mean of 0.4 mg/m^2/day and geometric mean of 0.3 mg/m^2/day.

A total of 90 dust samples were collected during the site-wide survey from the residences' vacuum cleaner bags and analyzed for lead. The sampler verified that the vacuum had not been used anywhere outside the home since the bag was last changed. Lead concentrations ranged from 68 mg/kg to 7470 mg/kg in Kellogg, with an arithmetic mean of 1180 mg/kg and a geometric mean of 832 mg/kg lead. In Smelterville, lead concentrations ranged from 65 mg/kg to 1590 mg/kg, with an arithmetic mean of 666 mg/kg and a geometric mean of 439 mg/kg.

2.2.3 1999 House Dust Survey

In the summer of 1999, a total of 181 dust mats were collected during PHD's annual blood lead survey of children. After collection, these dust mats were vacuumed and analyzed for lead. Of the dust mats collected, 180 were included in the dust and lead loading portion of the analysis. These mats were placed at homes and remained for an average of 30 days. Individual lead concentrations in mat dusts ranged from 97 mg/kg in Smelterville to 32,100 mg/kg in Pinehurst. The arithmetic mean mat dust lead concentration was 1062.6 mg/kg with a geometric mean of 682.8 mg/kg. An average of 10.2 g of dust and 13 mg of lead was found on the mats site-wide. The lead loading rate ranged from 0.01 mg/m^2/day to 71 mg/m^2/day, with an arithmetic mean of 1.4 mg/m^2/day and a geometric mean of 0.4 mg/m^2/day.

A total of 106 vacuum bag samples were analyzed for lead, arsenic, and cadmium as part of the 1999 PHD house dust sampling effort. These vacuum bag samples were collected from the same homes where mats were placed. Individual lead concentrations ranged from 45.4 mg/kg in Pinehurst to 15,300 mg/kg in Kellogg. The site-wide arithmetic mean lead concentration was 743 mg/kg with a geometric mean lead concentration of 477 mg/kg. Individual arsenic concentrations ranged from below detection to 120 mg/kg, with an arithmetic mean of 19.8 mg/kg and a geometric mean of 11.2 mg/kg. Individual cadmium concentrations ranged from 0.56 mg/kg to 29.1 mg/kg, with an average of 8.2 mg/kg and a geometric mean of 6.8 mg/kg.

A third annual site-wide interior dust sampling event was conducted in the summer of 1999, which included both vacuum bag and dust mat sampling in Smelterville, Kellogg, and Wardner. A total of 175 mats were collected, vacuumed, and analyzed for lead, and 174 were incorporated into the loading portion of the survey. Mats remained in homes for an average of 37 days. Kellogg mats exhibited lead concentrations ranging from 90 mg/kg to 7750 mg/kg, and had an arithmetic mean of 1254.5 mg/kg with a geometric mean of 961.4 mg/kg. An average of 4.3 g of dust and 6.1 mg of lead was collected from each Kellogg mat. The lead loading rate for Kellogg ranged from 0.004 mg/m^2/day to 5.6 mg/m^2/day, with an arithmetic mean of 0.6 mg/m^2/day and a geometric mean of 0.2 mg/m^2/day. Smelterville mat lead concentrations ranged from 210 mg/kg to 57,600 mg/kg, and had an arithmetic mean of 2345.2 mg/kg and a geometric mean of 812.6 mg/kg. An average of 6.7 g of dust and 8.3 mg of lead was collected from each mat. Lead loading rates for Smelterville ranged from 0.01 mg/m^2/day to 6.8 mg/m^2/day, with an arithmetic mean of 0.6 mg/m^2/day and geometric mean of 0.2 mg/m^2/day. Lead concentrations in Wardner mats ranged from 305 mg/kg to 18,400 mg/kg, and had an arithmetic mean of 2962.8 mg/kg and a geometric mean of 1377.7 mg/kg. An average of 8.4 g of dust and 113.6 mg of lead was collected from each mat. The Wardner lead loading rate ranged from 0.02 mg/m^2/day to 124.7 mg/m^2/day, with an arithmetic mean of 12.8 mg/m^2/day and geometric mean of 0.4 mg/m^2/day.

A total of 124 vacuum bag dust samples were collected and analyzed for lead as part of the 1999 site-wide house dust survey. Lead concentrations ranged from 99 mg/kg to 8440 mg/kg in Kellogg, with an arithmetic mean of 825.8 mg/kg and a geometric mean of 632.8 mg/kg lead. In Smelterville, lead concentrations ranged from 14 mg/kg to 6680 mg/kg, with an arithmetic mean of 812.3 mg/kg and a geometric mean of 468.8 mg/kg. Lead concentrations in Wardner ranged from 294 mg/kg to 2760 mg/kg, with an arithmetic mean of 1193.7 mg/kg and a geometric mean of 964.2 mg/kg.

2.3 2000 Sampling Event QA/QC Summary

PHD has sampled interior dust since the early 1970s; that program is independent of the site-wide interior dust sampling program. However, because the sampling programs occurred at the same time, TerraGraphics performed quality assurance analyses on PHD's data and has included them in this report. In addition, TerraGraphics has a cooperative agreement with the University of Idaho to use the Chemical Engineering Department's laboratory facilities to vacuum the dust mats. As a result, all mats collected by PHD are integrated with those collected by the site-wide survey for dust extraction (vacuuming) at the University. This helps assure consistency by minimizing variables related to dust extraction methods and techniques. All vacuum bag dusts and mat dust (after dust extraction) were sieved to 80 mesh prior to laboratory analysis. A complete review of 2000 PHD and site-wide vacuum and dust mat QA/QC findings and analysis is provided in Appendix A. Corresponding laboratory data sheets are found in Appendix B.

2.3.1 QA/QC Results for PHD 2000 Vacuum Sampling

A total of 103 vacuum dust samples (including QA/QC) were collected from homes in Kellogg, Elizabeth Park, Page, Pinehurst, Wardner, and Smelterville and submitted for lead, arsenic, and cadmium analysis at Silver Valley Labs (SVL), in Smelterville, Idaho. All samples were analyzed using the Inductively-Coupled Plasma (ICP) geochemical method and approximately one out of every ten samples were analyzed again using the USEPA-Contract Laboratory Program (CLP) method. The USEPA-CLP samples are considered to be laboratory duplicates and were used to assess the precision of the ICP method. The ICP geochemical method used a low temperature aqueous reagent utilizing very little sample, and these samples were analyzed in SVL's mineral division. The USEPA-CLP method used a high temperature multi-acid digestion while using a moderate amount of sample.

Six standards from the National Institute of Standards and Technology (NIST) were submitted blind to the lab and were used to check for accuracy of laboratory analysis. The six standards were analyzed using both the ICP and USEPA-CLP method. The ICP method resulted in arsenic percent recoveries for the standards outside of the acceptable range. Based on these standard results for arsenic, all the arsenic concentrations were qualified as estimates. The ICP method resulted in cadmium percent recoveries outside the acceptable range for three samples and samples batched with these standards were qualified as estimates for cadmium. No samples were qualified as estimates for lead based on the ICP standard percent recovery results. The USEPA-CLP standard concentration results were always lower compared to SVL's ICP results.

All laboratory prep blanks were below instrument detection limits. An internal check of SVL's laboratory accuracy was assessed using laboratory control samples (LCS). One LCS sample was outside of the acceptable percent recovery range for arsenic. Laboratory duplicates were analyzed as an internal check of laboratory precision. Two laboratory duplicate relative percent differences (RPDs) for arsenic were outside of the acceptable range. There were four laboratory duplicates with RPDs for cadmium outside of the acceptable range. One high RPD for a cadmium duplicate was associated with small differences in concentration. Sample batches associated with the other three laboratory duplicates were qualified as estimates for cadmium. Three laboratory duplicates had RPDs for lead outside of the acceptable range. All samples batched with these duplicates were qualified as estimates for lead.

Eleven of the ICP samples were analyzed again using the USEPA-CLP method. These duplicates had relatively high RPDs for arsenic, cadmium, and lead. The average RPDs were 71.7% (arsenic), 12.6% (cadmium), and 14.5% (lead). Because of the differences between analysis techniques, no samples were qualified as estimates based on these USEPA-CLP duplicate results. The USEPA-CLP QA/QC samples (LCS, duplicates, and spikes) were all within acceptable limits.

No samples were rejected based on a complete review of the standards, ICP prep blanks, LCS, and duplicates, CLP duplicates, USEPA-CLP LCS, duplicates, and spikes. Final completeness for the survey was assessed at 100%.

2.3.2 QA/QC Results for Site-Wide 2000 Vacuum Sampling

A total of 217 vacuum dust samples (including QA/QC) were collected from homes in Kellogg, Page, Pinehurst, Smelterville, and Wardner and submitted for lead analysis to Northern Analytical Laboratories, Inc. in Billings, Montana. Field QA/QC samples consisted of twelve duplicates and twelve standards (with known lead concentrations) that were submitted blind to the lab. Average percent recovery for the standards was 91.4%. Average RPD for the duplicates was 7.4%. The laboratory's QA/QC procedures were all acceptable. Based on a review of all QA/QC protocols of field duplicates, standards, prep blanks, LCS, and Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis, completeness for this survey was assessed at 100%.

2.3.3 QA/QC Results for PHD and Site-Wide 2000 Mat Dust Sampling

A total of 427 dust mat samples (including QA/QC) were collected by the site-wide and PHD surveys. Mats were collected from homes in Kellogg, Page, Pinehurst, Smelterville, and Wardner. All dust mat samples were analyzed for total lead at Northern Analytical. Field QA/QC samples consisted of twenty field duplicates. The average RPD for duplicate samples was 18.4%, and RPDs ranged from 0.5% to 60.8%. The degree of variability is consistent with earlier dust mat sampling programs.

A mat standard is created by loading 10 g of a standard with known lead concentration onto a mat and vacuuming it off. A total of 22 standards were submitted blind to the lab. The average percent recovery for standard lead concentration was 66%. This low percent recovery is similar to percent recoveries found in the 1997 through 1999 surveys. The reduced percent recoveries are likely attributable to mat fiber dilution of vacuumed dust mat samples or a portion of the standard sticking to the vinyl backing of the mat. A total of 27 dust mats were rejected. Eighteen of these samples were rejected because two or more field sample labels could not be verified. Nine samples were rejected due to failure of sample identification protocols during laboratory analysis. Thirty-seven mat dust samples contained insufficient volumes, and were not analyzed.

Laboratory precision was assessed using aqueous LCS, soil LCS, MS/MSD, and prep blank analyses. All laboratory QC results were within the acceptable limits. Based on a complete review of the field duplicates, standards, LCS, prep blanks, and laboratory MS/MSD analyses, the final completeness for the survey was assessed at 93%.

For the loading portion of the survey, 81 mat dust samples were qualified as estimates based on residents' answers to the questionnaire given upon retrieval of the dust mats. Loading calculations for 7 samples were considered estimates because the residents indicated that they were gone from the home 10 or more days. Four dust mat samples had been vacuumed by the resident at least once, 19 samples had been moved from one location to another, and 32 dust mats had been shaken out one or more times. Nineteen dust mat samples had a combination of two or more of the above. In all of these cases the loading calculations were qualified as estimates.

2.3.4 Data Excluded from Analyses

Excluding QA/QC samples, 27 dust mat samples were rejected from the PHD and site-wide dust mat surveys. No samples were rejected from the PHD or site-wide vacuum dust surveys. A full description of QA/QC findings for all four surveys is presented in Appendix A.

SECTION 3.0 2000 HOUSE DUST SURVEY RESULTS AND DISCUSSION

3.1 Sample Locations

PHD sample locations were selected based on participation in the 2000 PHD annual LHIP blood lead screening. Samplers went door to door and interviewed residents. If there was a child between the ages of nine months and nine years present at the residence, and the residents agreed to participate in the blood lead survey, vacuum dust was sampled and/or a dust mat was placed.

In the site-wide survey a broad base of homes in Kellogg, Page, Pinehurst, Smelterville, and Wardner was selected. In general, coverage was determined by the sampling budget and the subsequent limitation of sample numbers. If the resident was home and agreed to take part in the survey, a vacuum sample was collected and a dust mat was placed at the residence, regardless of whether children were present in the home.

3.2 PHD Vacuum Bag Sample Results

Arsenic and cadmium were analyzed in the PHD vacuum dust program during 2000 to assess the concentrations of other metals of concern. However, lead is the primary metal of concern at the Bunker Hill Superfund Site and used to determine cleanup measures. It is generally found that, in most cases, other metals are not elevated unless lead is also elevated. As a result, remedial strategies to clean up lead also abate other metals. PHD vacuum dust lead data are summarized in Table 1. A total of 97 vacuum bag samples were analyzed for lead, arsenic, and cadmium as part of the 2000 PHD sampling effort. Site-wide individual lead concentrations ranged from 49 mg/kg to 11,200 mg/kg, both in Kellogg. The site-wide arithmetic mean and geometric mean lead concentrations were 681 mg/kg and 432 mg/kg, respectively. Excluding Wardner's only sample (1500 mg/kg), Kellogg had the highest lead arithmetic mean, at 817 mg/kg, and Page had the lowest arithmetic mean (153 mg/kg), although only two samples were collected. Fifteen percent (15%) of the vacuum samples from Kellogg, 0% from Page, 12% from Pinehurst, 7% of the samples from Smelterville, and 100% (only one sample collected) of the samples from Wardner exhibited lead concentrations greater than 1000 mg/kg.

Of the 97 vacuum samples, 6 were below detection for arsenic and 2 were below detection for cadmium; the arithmetic mean and geometric means were calculated using half the detection limit for these samples. Individual arsenic concentrations ranged from below detection to 120 mg/kg, with an arithmetic mean of 40 mg/kg and a geometric mean of 32 mg/kg (Table 1). In November 2000, Region 9 of the USEPA released updated Preliminary Remediation Goals (PRGs) for screening residential soils based on human health criteria (USEPA 2000). The residential soil PRGs for arsenic are 0.39 mg/kg (carcinogenic) and 22 mg/kg (non-carcinogenic). Natural arsenic background concentrations in the Silver Valley are near 22 mg/kg (Gott and Cathrall 1980). As a result, 22 mg/kg is a useful level for comparison. Individual cadmium concentrations ranged from below detection to 28 mg/kg, with an average of 6 mg/kg and a geometric mean of 5 mg/kg. The soil PRG for cadmium is 37 mg/kg for noncancer health effects. None of the PHD vacuum samples had concentrations of cadmium above 37 mg/kg.

3.3 PHD Dust Mat Sample Results

2000 PHD dust mat data are summarized in Table 1. One hundred fifty (150) mats were included for lead analysis and lead loading analysis. PHD dust mats were not analyzed for arsenic or cadmium due to budget limitations. These mats were placed in homes for an average of 28 days. Site-wide individual lead concentrations in mat dusts ranged from 70 mg/kg to 7830 mg/kg, both in Pinehurst and averaged 904 mg/kg with a geometric mean of 637 mg/kg. An average of 7.98 g of dust and 5.51 mg of lead was found on the mats site-wide. The dust loading rate ranged from 2.86 mg/m^2/day to 9151 mg/m^2/day, with an arithmetic mean of 914 mg/m^2/day and a geometric mean of 587 mg/m^2/day. The lead loading rate ranged from 0.001 mg/m^2/day to 4.86 mg/m^2/day, with an arithmetic mean of 0.63 mg/m^2/day and a geometric mean of 0.37 mg/m^2/day. Thirty-six of the 88 (41%) Kellogg samples had concentrations greater than 1000 mg/kg. None of the four (0%) Page samples and 5 of the 43 (12%) Pinehurst samples contained more than 1000 mg/kg lead. None of the 13 (0%) Smelterville samples and 1 of the 2 (50%) Wardner samples exhibited lead concentrations greater than 1000 mg/kg.

3.4 Site-Wide Vacuum Bag Sample Results

A summary of 2000 site-wide vacuum dust data appears in Table 2. A total of 208 vacuum bag dust samples were collected and analyzed for lead as part of the 2000 site-wide sampling event. Lead concentrations in Kellogg ranged from 37 mg/kg to 3720 mg/kg, with an arithmetic mean of 748 mg/kg and a geometric mean of 567 mg/kg lead. Only three vacuum dust samples were collected in Page. Lead concentrations in Page ranged from 451 mg/kg to 941 mg/kg, with an arithmetic mean of 723 mg/kg and a geometric mean of 691 mg/kg lead. Lead concentrations in Pinehurst ranged from 40.0 mg/kg to 2640 mg/kg, with an arithmetic mean of 544 mg/kg and a geometric mean of 419 mg/kg lead. Lead concentrations in Smelterville ranged from 38 mg/kg to 30,900 mg/kg, with an arithmetic mean of 1158 mg/kg and a geometric mean of 495 mg/kg. Lead concentrations in Wardner ranged from 330 mg/kg to 2700 mg/kg, with an arithmetic mean of 934 mg/kg and a geometric mean of 756 mg/kg. Twenty-four (24%) of the 103 Kellogg samples, 0% of the Page samples, 7% of the Pinehurst samples, 20% of the Smelterville samples, and 20% of the Wardner samples exhibited lead concentrations greater than 1000 mg/kg.

3.5 Site-Wide Dust Mat Sample Results

A summary of the site-wide dust mat data is presented in Table 2. A total of 179 dust mats from Kellogg, Page, Pinehurst, Smelterville, and Wardner were included in the data analysis and lead loading portion of the survey. These mats were placed in homes and used for an average of 31 days. Lead concentrations in Kellogg mats ranged from 200 mg/kg to 15,500 mg/kg, and had an arithmetic mean of 1470 mg/kg and a geometric mean of 975 mg/kg. An average of 3.53 g of dust and 5.33 mg of lead was collected from each mat. The Kellogg dust loading rate ranged from 14.1 mg/m^2/day to 2250 mg/m^2/day, with an arithmetic mean of 354 mg/m^2/day and a geometric mean of 243 mg/m^2/day. The Kellogg lead loading rate ranged from 0.004 mg/m^2/day to 9.56 mg/m^2/day, with an arithmetic mean of 0.53 mg/m^2/day and a geometric mean of 0.24 mg/m^2/day.

Four dust mats were collected in Page. Lead concentrations in Page mats ranged from 180 mg/kg to 1400 mg/kg, and had an arithmetic mean of 731 mg/kg and a geometric mean of 579 mg/kg (Table 2). An average of 5.28 g of dust and 4.65 mg of lead was collected from each mat. The Page dust loading rate ranged from 284 mg/m^2/day to 806 mg/m^2/day, with an arithmetic mean of 519 mg/m^2/day and a geometric mean of 482 mg/m^2/day. The Page lead loading rate ranged from 0.05 mg/m^2/day to 1.13 mg/m^2/day, with an arithmetic mean of 0.46 mg/m^2/day and a geometric mean of 0.28 mg/m^2/day.

Lead concentrations in 24 Pinehurst mats ranged from 240 mg/kg to 2060 mg/kg, and had an arithmetic mean of 585 mg/kg and a geometric mean of 502 mg/kg. An average of 5.45 g of dust and 3.33 mg of lead was collected from each mat. The Pinehurst dust loading rate ranged from 80.4 $mg/m^2/day$ to 2420 $mg/m^2/day$, with an arithmetic mean of 611 $mg/m^2/day$ and a geometric mean of 414 $mg/m^2/day$. The lead loading rate ranged from 0.03 $mg/m^2/day$ to 1.83 $mg/m^2/day$, with an arithmetic mean of 0.38 $mg/m^2/day$ and a geometric mean of 0.21 $mg/m^2/day$.

Lead concentrations in 55 Smelterville mats ranged from 190 mg/kg to 4110 mg/kg, and had an arithmetic mean of 835 mg/kg and a geometric mean of 634 mg/kg. An average of 5.91 g of dust and 5.69 mg of lead was collected from each mat. The dust loading rate ranged from 87.4 $mg/m^2/day$ to 2698 $mg/m^2/day$, with an arithmetic mean of 612 $mg/m^2/day$ and a geometric mean of 450 $mg/m^2/day$. The Smelterville lead loading rate ranged from 0.04 $mg/m^2/day$ to 8.94 $mg/m^2/day$, with an arithmetic mean of 0.59 $mg/m^2/day$ and geometric mean of 0.29 $mg/m^2/day$.

Lead concentrations in 7 Wardner mats ranged from 486 mg/kg to 2780 mg/kg, and had an arithmetic mean of 1071 mg/kg and a geometric mean of 854 mg/kg. An average of 2.30 g of dust and 3.18 mg of lead was collected from each mat. The dust loading rate ranged from 131 $mg/m^2/day$ to 377 $mg/m^2/day$, with an arithmetic mean of 216 $mg/m^2/day$ and a geometric mean of 198 $mg/m^2/day$. The Wardner lead loading rate ranged from 0.08 $mg/m^2/day$ to 1.05 $mg/m^2/day$, with an arithmetic mean of 0.30 $mg/m^2/day$ and geometric mean of 0.17 $mg/m^2/day$.

A total of 38 of the 89 (43%) Kellogg dust mat samples had lead concentrations greater than 1000 mg/kg. Of the four samples collected from Page, one exceeded 1000 mg/kg lead (25%). Four of the 24 (17%) Pinehurst dust mat samples had lead concentrations greater than 1000 mg/kg. A total of 14 of the 55 (25%) Smelterville dust mat samples and 2 of the 7 (29%) Wardner dust mat samples exhibited lead concentrations greater than 1000 mg/kg.

3.6 Dust Mat/Vacuum Paired Sample Results

Direct comparison of vacuum bag and dust mat results was accomplished by combining results on a house by house basis. Both vacuum bag and dust mat lead results are available for numerous houses. A summary of the 2000 PHD and site-wide paired data is presented in Table 3. The 2000 PHD and site-wide combined sample data yielded a total of 240 paired observations (124 pairs from Kellogg, 5 from Page, 43 from Pinehurst, 60 from Smelterville, and 8 from Wardner). A paired analysis of this type provides insight into the similarities and differences in the sampling techniques employed on site. A statistical analysis of the paired data for all 1996-1998 dust data are included in the *1999 Five Year Review Report.* This report concluded that the two sampling techniques yield significantly different results. Further analysis and possible explanation for differences in results between the two sampling techniques is also discussed (TerraGraphics 2000a). Paired t-tests were performed on the 1999 paired mat and vacuum dust data for all sites and both PHD and site-wide lead concentrations. Significant differences were still observed ($P \leq 0.0001$ and $P \leq 0.003$) (TerraGraphics 2000b).

Table 1 2000 PHD House Dust Data Summary

Community	Total No. of Days Mat Out	Total Dust Collected (g)	Dust Loading (mg/m²/day)	Total Lead Collected (mg)	Lead Loading (mg/m²/day)	Mat Lead Conc. (mg/kg)	Vacuum Lead Conc. (mg/kg)	Vacuum Cadmium Conc. (mg/kg)	Vacuum Arsenic Conc. (mg/kg)
All Sites									
Number	150	150	150	150	150	150	97	97	97
Arithmetic Mean/Average	28	7.98	914.27	5.51	0.633	904	681	6	40
Standard Deviation	5	10.23	1163.87	6.40	0.754	968	1205	5	26
Minimum	20	0.02	2.86	0.01	0.001	70	49	<1	<10
Maximum	48	84.39	9150.94	40.17	4.860	7830	11200	28	120
Geometric Mean	28	5.16	586.75	3.29	0.373	637	432	5	32
Kellogg									
Number	88	88	88	88	88	88	53	53	53
Arithmetic Mean/Average	28	6.61	772.19	6.06	0.702	1105	817	6	34
Standard Deviation	5	7.46	939.98	6.09	0.730	884	1569	4	26
Minimum	20	1.21	115.30	0.55	0.080	174	49	<1	<10
Maximum	48	45.82	6549.46	28.56	3.390	4880	11200	27	120
Geometric Mean	27	4.71	539.20	4.02	0.460	854	464	5	26
Page									
Number	4	4	4	4	4	4	2	2	2
Arithmetic Mean/Average	30	20.16	2126.26	6.31	0.670	334	153	2	20
Standard Deviation	2	10.67	1064.04	2.69	0.284	105	95	1	11
Minimum	27	10.75	1090.48	3.63	0.380	220	86	1	12
Maximum	31	35.47	3598.09	9.75	0.990	448	220	3	28
Geometric Mean	30	18.32	1940.01	5.88	0.624	321	138	2	18

Table 1 2000 PHD House Dust Data Summary (cont.d)

Community	Total No. of Days Mat Out	Total Dust Collected (g)	Dust Loading (mg/m^2/day)	Total Lead Collected (mg)	Lead Loading (mg/m^2/day)	Mat Lead Conc. (mg/kg)	Vacuum Lead Conc. (mg/kg)	Vacuum Cadmium Conc. (mg/kg)	Vacuum Arsenic Conc. (mg/kg)
Pinehurst									
Number	43	43	43	43	43	43	26	26	26
Arithmetic Mean/Average	27	9.80	1139.46	4.82	0.563	647	537	7	53
Standard Deviation	3	14.80	1600.94	7.93	0.916	1192	537	6	27
Minimum	21	0.02	2.86	0.01	0.001	70	150	3	15
Maximum	33	84.39	9150.94	40.17	4.860	7830	2300	28	120
Geometric Mean	27	5.15	606.89	2.10	0.244	405	396	5	47
Smelterville									
Number	13	13	13	13	13	13	15	15	15
Arithmetic Mean/Average	31	8.05	831.84	3.78	0.383	487	466	6	39
Standard Deviation	3	4.92	543.29	3.04	0.318	205	244	3	13
Minimum	28	1.93	202.31	0.77	0.080	162	150	2	20
Maximum	40	17.98	1949.69	10.69	1.080	786	1100	11	71
Geometric Mean	31	6.68	674.02	2.94	0.297	441	416	5	37
Wardner									
Number	2	2	2	2	2	2	1	1	1
Arithmetic Mean/Average	31	4.24	435.60	5.51	0.635	1420	1500	22	72
Standard Deviation	10	1.03	34.38	2.79	0.488	1004			
Minimum	24	3.51	411.29	3.53	0.290	710	1500	22	72
Maximum	38	4.97	459.91	7.48	0.980	2130	1500	22	72
Geometric Mean	30	4.18	434.92	5.14	0.533	1230	1500	22	72

Table 2 2000 Site-Wide House Dust Data Summary

Community	Total No. of Days Mat Out	Total Dust Collected (g)	Dust Loading (mg/m^2/day)	Total Lead Collected (mg)	Lead Loading (mg/m^2/day)	Mat Lead Conc. (mg/kg)	Vacuum Lead Conc. (mg/kg)
All Sites							
Number	179	179	179	179	179	179	208
Arithmetic Mean/Average	31	4.51	465.90	5.07	0.519	1124	855
Standard Deviation	4	4.20	461.69	10.43	1.056	1636	2175
Minimum	26	0.13	14.10	0.04	0.004	180	37
Maximum	53	22.31	2698.36	103.35	9.560	15500	30900
Geometric Mean	31	3.13	317.60	2.41	0.244	768	528
Kellogg							
Number	89	89	89	89	89	89	103
Arithmetic Mean/Average	32	3.53	353.78	5.33	0.530	1470	748
Standard Deviation	4	3.33	352.47	11.59	1.098	2173	592
Minimum	27	0.13	14.10	0.04	0.004	200	37
Maximum	53	20.75	2250.05	103.35	9.560	15500	3720
Geometric Mean	32	2.45	242.97	2.39	0.237	975	567
Page							
Number	4	4	4	4	4	4	3
Arithmetic Mean/Average	32	5.28	519.12	4.65	0.458	731	723
Standard Deviation	0	2.30	225.90	4.74	0.467	508	249
Minimum	32	2.89	284.00	0.52	0.050	180	451
Maximum	32	8.20	805.82	11.48	1.130	1400	941
Geometric Mean	32	4.91	482.19	2.84	0.278	579	691

Table 2 2000 Site-Wide House Dust Data Summary (cont.d)

Community	Total No. of Days Mat Out	Total Dust Collected (g)	Dust Loading (mg/m²/day)	Total Lead Collected (mg)	Lead Loading (mg/m²/day)	Mat Lead Conc. (mg/kg)	Vacuum Lead Conc. (mg/kg)
Pinehurst							
Number	24	24	24	24	24	24	28
Arithmetic Mean/Average	28	5.45	611.20	3.33	0.377	585	544
Standard Deviation	3	5.15	583.33	3.98	0.456	404	485
Minimum	26	0.69	80.36	0.28	0.030	240	40
Maximum	36	21.55	2420.26	16.31	1.830	2060	2640
Geometric Mean	28	3.72	413.77	1.87	0.207	502	419
Smelterville							
Number	55	55	55	55	55	55	64
Arithmetic Mean/Average	31	5.91	611.81	5.69	0.594	835	1158
Standard Deviation	4	4.88	539.62	11.30	1.253	729	3826
Minimum	26	0.75	87.35	0.32	0.040	190	38
Maximum	42	22.31	2698.36	79.57	8.940	4110	30900
Geometric Mean	31	4.39	449.67	2.78	0.285	634	495
Wardner							
Number	7	7	7	7	7	7	10
Arithmetic Mean/Average	34	2.30	216.31	3.18	0.300	1071	934
Standard Deviation	3	1.03	101.59	3.97	0.382	877	724
Minimum	32	1.36	130.55	0.85	0.080	486	330
Maximum	41	3.96	377.36	11.01	1.050	2780	2700
Geometric Mean	34	2.13	198.09	1.82	0.167	854	756

Table 3 2000 PHD and Site-Wide Combined Paired Data

	Number of Pairs	Geometric Mean Mat Lead Conc. (mg/kg)	Geometric Mean Vacuum Lead Conc. (mg/kg)	Correlation Coefficient (R)	Paired T-Test P-Value
Kellogg	124	929	524	0.36	<0.0001
Page	5	418	362	NA	NA
Pinehurst	43	415	373	0.14	0.41
Smelterville	60	590	499	0.61	0.074
Wardner	8	958	814	NA	NA
All Sites	240	707	491	0.44	<0.0001

NA: Insufficient data

Combined 2000 paired data for PHD and site-wide surveys for all sites were again significantly different after performing a paired t-test ($P < 0.0001$). Combined paired data for Kellogg was significantly different for lead concentrations ($P < 0.0001$), but Pinehurst and Smelterville paired data were not significantly different ($P > 0.07$). Page and Wardner did not yield enough pairs to provide an accurate analysis. The site-wide difference observed is a reflection of the number of pairs in Kellogg. These data reveal that dust mat and vacuum bag lead concentrations are beginning to converge in Smelterville (where soil remediation is complete) and in Pinehurst. Kellogg soil remediation is incomplete and is expected to continue into the next few years. Because sections of Kellogg remain unremediated, the dust mats reflect those higher concentrations migrating into the houses. Although dust lead levels are different, they are correlated ($r=0.44$). Because the dust mats are a newer sampling methodology, it is of interest to determine how vacuum bags relate to the dust mat technique. A regression analysis of (log transformed) vacuum bag lead concentrations on (log transformed) mat lead concentrations show that vacuum bags explain approximately 20% of the variation in dust mat lead concentrations ($R^2=0.2$).

SECTION 4.0 SUMMARY AND CONCLUSIONS

A total of 305 vacuum dust and 329 mat dust results are available from dust samples collected in the site-wide and PHD surveys during the 2000 sampling season. Dust mat and/or vacuum samples were collected by PHD from homes where children participated in PHD's 2000 annual blood lead survey. Dust mat and vacuum samples were collected by the site-wide survey from homes chosen to provide good geographic representation in Kellogg, Page, Pinehurst, Smelterville, and Wardner.

Reducing house dust lead levels to concentrations similar to soils is an important component in the risk-reduction strategy for the site. RAOs for dust of less than 500 mg/kg lead community geometric mean with no individual home exceeding 1000 mg/kg were adopted for the site. The

RAOs were established prior to the dust mat methodology, but while the vacuum bag sampling methodology was being used.

Results of the PHD 2000 Survey indicated a site-wide arithmetic mean lead concentration of 681 mg/kg and a geometric mean of 432 mg/kg for vacuum samples. Samples collected site-wide from mats showed significantly higher concentrations of lead, with an arithmetic mean of 904 mg/kg and a geometric mean of 637 mg/kg. The 2000 site-wide arithmetic mean concentration for vacuum samples was 855 mg/kg, and the geometric mean was 528 mg/kg. The site-wide dust mat survey exhibited arithmetic and geometric mean concentrations of 1124 mg/kg and 769 mg/kg, respectively.

Results for previous years and the progress toward meeting the house dust RAOs are discussed in the *1999 Five Year Review Report* (TerraGraphics 2000a) and in the *1999 Interior House Dust Data Summary Report* (TerraGraphics 2000b). As remediation is completed in Smelterville and continues in Kellogg and Pinehurst, house dust levels have been examined and compared to the RAOs for all years since 1988. PHD house dust lead concentrations in Smelterville and Kellogg have continued to decrease from geometric means in the 1200 mg/kg to 1800 mg/kg range in 1988-1990, to geometric means of 416 to 464 mg/kg in 2000.

PHD geometric mean house dust lead concentrations of vacuum bag samples are below the 500 mg/kg RAO in 2000. However, approximately 13% of vacuum bag samples still exhibit concentrations greater than 1000 mg/kg lead. Geometric mean vacuum bag lead concentrations from the site-wide survey data exceed the RAO of 500 mg/kg, except in Pinehurst and Smelterville. However, 7% and 20% of homes in Pinehurst and Smelterville exceed 1000 mg/kg, respectively. Kellogg and Wardner are the only towns with dust mat geometric means above 500 mg/kg (PHD data). However, site-wide dust mat data show geometric means in each community exceeding 500 mg/kg.   In general, house dust lead concentrations are beginning to fall below the RAO of 500 mg/kg; however, several homes remain with lead concentrations exceeding 1000 mg/kg.

SECTION 5.0 REFERENCES

CH2MHill. 1991. Final House Dust Remediation Report for the Bunker Hill CERCLA Site Populated Areas RI/FS. May 1991.

Gott, G.B. and J.B. Cathrall. 1980. Geochemical Exploration Studies in the Coeur d'Alene District, Idaho, and Montana. Geological Survey Professional Paper 1116, U.S. Department of Interior. U.S. Government Printing Office, Washington D.C.

TerraGraphics Environmental Engineering, Inc. 1990. Risk Assessment Data Evaluation Report (RADER) for the Populated Areas of the Bunker Hill Superfund Site. TES Contract No. 68-W9-0008, WA#C10012. Prepared for USEPA, Region X. October 1990.

TerraGraphics Environmental Engineering, Inc. 1999a. 1997 Interior House Dust and Smelterville Rights of Way Data Summary Report, Prepared for Idaho Division of Environmental Quality, 1999.

TerraGraphics Environmental Engineering, Inc. 1999b. 1998 Interior House Dust Data Summary Report, Prepared for Idaho Division of Environmental Quality, 1999.

TerraGraphics Environmental Engineering, Inc. 2000a. 1999 Five Year Review Report Bunker Hill Superfund Site, 2000.

TerraGraphics Environmental Engineering, Inc. 2000b. 1999 Interior House Dust Data Summary Report, Prepared for Idaho Division of Environmental Quality, 2000.

TerraGraphics Environmental Engineering, Inc. 2000c. 2000 FINAL Field Work Plan for Interior Dust Sampling, 2000.

TerraGraphics Environmental Engineering, Inc. 2000d. 1999 Annual Summary- Blood Lead Absorption and Exposure Survey, 2000.

U.S. Environmental Protection Agency (USEPA). 1991. Record of Decision (ROD) - Bunker Hill Mining and Metallurgical Complex, Residential Soils Operable Unit, Shoshone County, Idaho, August 1991.

U.S. Environmental Protection Agency (USEPA). 1992. Record of Decision - Bunker Hill Mining and Metallurgical Complex. Shoshone County, Idaho. September 1992.

U.S. Environmental Protection Agency (USEPA). 2000. *Region 9 Preliminary Remediation Goals (PRGs)*. www.epa.gov/region09/waste/sfund/prg/. Last Revision: November 1, 2000.

APPENDIX A
QA/QC MEMORANDA

121 South Jackson Street
Moscow, Idaho 83843
Phone: 208-882-7858
Fax: 208-883-3785
108 West Idaho Street
Kellogg, Idaho 83837
Phone: 208-786-1206
Fax: 208-786-1209
http:/ / www.tgenviro.com
office@tgenviro.com

INTERNAL MEMORANDUM

To: Gerald B. Lee, TerraGraphics, Moscow

From: Shanda LeVan, TerraGraphics, Moscow

Date: December 7, 2000

Subject: QA/QC Review for the 2000 Panhandle Health District Vacuum Dust Data

---

Introduction

The following memorandum summarizes the quality assurance/quality control (QA/QC) review for the 2000 Panhandle Health District (PHD) vacuum dust sampling which occurred in Kellogg Smelterville, Pinehurst, and Page. The vacuum dust sampling event occurred from July 6 through September 6, 2000.

General

A QA/QC review was completed to evaluate the precision, accuracy, completeness, and representativeness of the data obtained from both the field and the laboratory. PHD submitted the samples to SVL Analytical Laboratories of Smelterville, Idaho. All laboratory data and master logs were entered into database files and checked to ensure that samples were labeled and tracked correctly. Chain of custody forms were reviewed. All sample holding times were met. This data validation review indicated all samples were properly tracked during the project. SVL provided a copy of their internal QA/QC. PHD vacuum dust data are shown in Table 1.

Field Sampling QA/QC Results

A total of 103 vacuum samples (including QA/QC) were collected from homes located within the Bunker Hill Superfund Site. Field QA/QC consisted of National Institute of Standards and Technology (NIST) standards inserted into the sample train. Standard results are discussed in the Laboratory Analysis section. No duplicate samples were collected in the field.

Laboratory Analysis

A total of 97 samples (excluding QA/QC) were submitted to SVL and analyzed for total arsenic, cadmium, and lead using the geochem method. Laboratory QA/QC was checked externally with NIST standards submitted blind. SVL provided a copy of their internal QA/QC results for blanks, laboratory control samples (LCS), and lab duplicates. Eleven samples (approximately one for every ten samples) were analyzed using the geochem method and again using the U.S. EPA-CLP method. Separate laboratory QA/QC samples were analyzed along with the 11 samples analyzed using the U.S. EPA-CLP method. These QA/QC samples included laboratory control samples, laboratory duplicates, and matrix spike samples.

External QA/QC

An external check for accuracy of laboratory analyses was assessed using NIST soil standards. A total of six NIST standards (approximately one for every 20 samples) containing 105 mg/kg arsenic, 41.7 mg/kg cadmium, and 1162 mg/kg lead were submitted blind to SVL and analyzed along with the 97 other samples using the geochem method. Geochem standard results are presented in Table 2. Standard percent recoveries for arsenic ranged from 123.8% to 152.4%, with an average of 136.5%, cadmium percent recoveries ranged from 76.7% to 83.9%, with an average of 80.3%, and lead percent recoveries ranged from 86.1% to 94.7%, with an average of 90.4%. All standard percent recoveries for arsenic were outside of the acceptable range, thus all samples were qualified as estimates for arsenic. Standards 00D020, 00D040, and 00D103 were below the acceptable percent recoveries for cadmium and all samples batched with these standards were qualified as estimates. All of the lead standard concentrations were within the acceptable percent recovery range.

The six NIST standards were also analyzed at SVL using the U.S. EPA-CLP method. The U.S. EPA-CLP Standard results are presented in Table 2 along with the geochem standard results. The CLP standard percent recoveries for arsenic ranged from 68.1% to 70.2%, with an average of 69.2%, cadmium percent recoveries ranged from 74.8% to 77.2% (76.1% average), and lead percent recoveries ranged from 76.1% to 78.1% (77.1% average). The U.S. EPA-CLP standard concentration results were always lower compared to SVL's geochem method results.

Internal QA/QC

Geochem Method

SVL analyzed a total of three prep blanks to ensure no bias was introduced during sample preparation. See Table 3 for prep blank results. All prep blanks were below instrument detection limits. No qualifiers were placed on the data based on SVL's prep blank results.

Internal checks of SVL's accuracy were assessed by analyzing three laboratory control samples (LCSs). LCS Results are presented in Table 4. One LCS sample (LCS3) had a percent recovery of 129.0% for arsenic, which is outside of the acceptable range specified by EPA CLP guidelines (75-120%). All arsenic results have already been previously qualified as estimates based on the standard results, in addition all samples batched with LCS3 have been determined to be estimates for arsenic based on LCS results. No other LCS percent recoveries were outside of the acceptable range.

A total of ten lab duplicates were also analyzed as an internal check of laboratory precision. Results for lab duplicate analysis are presented in Table 5. The relative percent difference (RPD) for the duplicate results ranged from 0.0 to 21.2 for arsenic, with an average of 11.3. Cadmium RPDs ranged from 0.0 to 66.7, with an average of 17.9. Lead RPDs ranged from 0.0 to 78.1, with an average of 17.7. The relative percent difference was outside of the control limit of ±20 RPD for one of the laboratory duplicates for arsenic, and one duplicate for arsenic had an original concentration of 14 mg/kg and a duplicate concentration that was below the instrument detection limit (<10 mg/kg). All of the arsenic samples have already been qualified as estimates, based on the standard results. There were four cadmium duplicates (00D029, 00D059, 00D069, and 00D099) with RPDs outside of the control limit. The high RPD value of 66.7 for duplicate 00D099 for cadmium was associated with small differences in concentration. All cadmium results for samples batched with 00D029, 00D059, and 00D069 were qualified as estimates. Three duplicate samples (00D039, 00D079, and 00D099) had RPDs outside of the control limit for lead, and lead results for samples batched with these duplicates were qualified as estimates.

U.S. EPA-CLP Duplicates

Eleven of the 103 samples analyzed with the geochem method have also been analyzed separately using the U.S. EPA-CLP method. These eleven samples will be called the CLP duplicate samples. The concentration results for each method and calculated relative percent differences are presented in Table 6. The concentration results for the samples analyzed CLP are almost always lower than the concentration results for the same samples analyzed using the geochem method. The calculated RPDs for arsenic ranged from 38.8 to 105.2, all of which are above the recommended control limit of ±20 RPD. The RPDs for cadmium ranged from 0.6 to 33.3, with an average of 12.6. The RPDs for lead ranged from 0.8 to 34.9 with an average of 14.5. Because of the vast differences in these two analysis techniques, no samples were qualified as estimates based on these results. All samples were sieved to - 80 mesh, then a portion of that was used for analysis using the geochem method, then another separate portion was used for analysis using the U.S. EPA-CLP method. The geochem method used a low temperature aqueous reagent utilizing very little sample, and these samples were analyzed in SVL's mineral division. The U.S. EPA-CLP method used a high temperature multi-acid digestion while utilizing a moderate amount of the sample.

The 11 samples analyzed using the U.S. EPA-CLP method had separate lab QA/QC samples. These QA/QC results are summarized in Tables 7A, 7B, and 7C. One laboratory control sample was analyzed for arsenic, cadmium, and lead. All percent recoveries were within the acceptable limits and were 94.7% for lead, 97.0% for cadmium, and 95.5% for arsenic. One lab duplicate was analyzed for arsenic, cadmium, and lead, relative percent differences were 2.3, 5.5, and 1.3, respectively. Two laboratory matrix spikes were analyzed for arsenic, cadmium, and lead. The percent recoveries ranged from 78.4% to 90.5%, and were all within the acceptable range. No samples were qualified as estimates based on the U.S. EPA-CLP method QA/QC samples.

ICP Serial Dilution Analysis was performed on sample 00D010. This sample was over 50 X the instrument detection limit (IDL). A five-fold serial dilution was performed and was within 10% of the original concentration after correcting for dilution. The percent difference was 7.7% for arsenic, 1.1% for cadmium, and 6.6% for lead. ICP Serial Dilution Analysis information is found in SVL's ILM04 Statement of Work.

Conclusions

Six NIST standards were used to check for accuracy of laboratory analysis. The standards were analyzed using two different protocols. The SVL geochem method's arsenic percent recovery results for the standards were all outside of the acceptable range. Based on these standard results for arsenic, all the arsenic concentrations have been qualified as estimates. The SVL geochem method's cadmium percent recoveries were outside the acceptable range for samples 00D020, 00D040, and 00D103 and samples batched with these standards were qualified as estimates. No samples were qualified as estimates for lead based on geochem standard percent recovery results.

The six NIST standards were also analyzed at SVL using the U.S. EPA-CLP method. The U.S. EPA-CLP standard concentration results were always lower compared to SVL's geochem method results. No samples were qualified as estimates based on the U.S. EPA-CLP standard results, because these results were primarily used as a QA/QC check of geochem standard results.

All laboratory prep blanks were below instrument detection limits. An internal check of SVL's laboratory accuracy was assessed using laboratory control samples. One laboratory control sample was outside of the acceptable percent recovery range for arsenic. Laboratory duplicates were analyzed as an internal check of laboratory precision. Two laboratory duplicates for arsenic were outside of the acceptable range. There were four laboratory duplicates (00D029, 00D059, 00D069, and 00D099) with RPDs for cadmium outside of the acceptable range. The high RPD value for duplicate 00D099 for cadmium was associated with small differences in concentration. All cadmium results for samples batched with 00D029, 00D059, and 00D069 were qualified as estimates. Three duplicates (00D039, 00D079, and 00D099) had RPDs for lead outside of the acceptable range. All samples batched with these duplicates were qualified as estimates for lead.

The 11 duplicate samples analyzed with the U.S. EPA-CLP as well as with the geochem method, had relatively high duplicate RPDs for arsenic, cadmium, and lead as are shown in Table 6. The average RPDs were 71.7% (arsenic), 12.6% (cadmium), and 14.5% (lead). Because of the many differences between analysis techniques, no samples were qualified based on these CLP duplicate results. The U.S. EPA-CLP QA/QC samples (laboratory control samples, duplicates, and spikes) were all within acceptable limits.

No samples were rejected based on a complete review of the standards, geochem prep blanks, LCS, and duplicates, CLP duplicates, U.S. EPA-CLP LCS, duplicates, and spikes. Final completeness for the study was assessed at 100%.

Table 1 - 2000 PHD Vacuum Dust Data

PHD Lab ID	Matrix	Units	Arsenic Concentration	Cadmium Concentration	Lead Concentration	Location
00D001	Dust	mg/kg	48 J	11 J	690	Smelterville
00D002	Dust	mg/kg	47 J	8 J	380	Smelterville
00D003	Dust	mg/kg	46 J	9 J	820	Smelterville
00D004	Dust	mg/kg	51 J	6 J	550	Smelterville
00D005	Dust	mg/kg	24 J	3 J	150	Smelterville
00D006	Dust	mg/kg	20 J	2 J	240	Smelterville
00D007	Dust	mg/kg	37 J	2 J	300	Smelterville
00D008	Dust	mg/kg	25 J	6 J	400	Smelterville
00D009	Dust	mg/kg	49 J	10 J	1100	Smelterville
00D010	Dust	mg/kg	40 J	6 J	390	Smelterville
00D011	Dust	mg/kg	24 J	3 J	310	Kellogg
00D012	Dust	mg/kg	13 J	3 J	170	Kellogg
00D013	Dust	mg/kg	35 J	5 J	330	Smelterville
00D014	Dust	mg/kg	12 J	1 J	86	Page
00D015	Dust	mg/kg	32 J	4 J	510	Smelterville
00D016	Dust	mg/kg	26 J	6 J	400	Smelterville
00D017	Dust	mg/kg	<10 UJ	1 J	150	Kellogg
00D018	Dust	mg/kg	33 J	4 J	420	Kellogg
00D019	Dust	mg/kg	120 J	2 J	230	Kellogg
00D021	Dust	mg/kg	39 J	4 J	280	Kellogg
00D022	Dust	mg/kg	26 J	4 J	690	Kellogg
00D023	Dust	mg/kg	<10 UJ	<1 UJ	50	Kellogg
00D024	Dust	mg/kg	24 J	5 J	620	Kellogg
00D025	Dust	mg/kg	45 J	5 J	300	Kellogg
00D026	Dust	mg/kg	33 J	4 J	2100	Kellogg
00D027	Dust	mg/kg	25 J	6 J	550	Kellogg
00D028	Dust	mg/kg	<10 UJ	2 J	3400	Kellogg
00D029	Dust	mg/kg	120 J	27 J	1300	Kellogg
00D030	Dust	mg/kg	73 J	4 J	240	Kellogg
00D031	Dust	mg/kg	42 J	5 J	530 J	Kellogg
00D032	Dust	mg/kg	44 J	6 J	1600 J	Kellogg
00D033	Dust	mg/kg	40 J	3 J	340 J	Kellogg
00D034	Dust	mg/kg	50 J	10 J	780 J	Kellogg
00D035	Dust	mg/kg	81 J	10 J	970 J	Kellogg
00D036	Dust	mg/kg	40 J	7 J	500 J	Kellogg
00D037	Dust	mg/kg	19 J	7 J	350 J	Kellogg
00D038	Dust	mg/kg	34 J	6 J	700 J	Kellogg
00D039	Dust	mg/kg	14 J	1 J	130 J	Kellogg
00D041	Dust	mg/kg	17 J	4	130	Kellogg
00D042	Dust	mg/kg	20 J	6	320	Kellogg
00D043	Dust	mg/kg	29 J	13	350	Kellogg
00D044	Dust	mg/kg	20 J	4	280	Kellogg
00D045	Dust	mg/kg	32 J	4	300	Kellogg

Table 1 - 2000 PHD Vacuum Dust Data (Cont'd)

PHD Lab ID	Matrix	Units	Arsenic Concentration	Cadmium Concentration	Lead Concentration	Location
00D046	Dust	mg/kg	32 J	10	610	Kellogg
00D047	Dust	mg/kg	64 J	7	2000	Kellogg
00D048	Dust	mg/kg	31 J	6	360	Kellogg
00D049	Dust	mg/kg	25 J	11	990	Kellogg
00D050	Dust	mg/kg	18 J	6	270	Kellogg
00D051	Dust	mg/kg	30 J	6 J	710	Kellogg
00D052	Dust	mg/kg	<10 UJ	2 J	180	Kellogg
00D053	Dust	mg/kg	16 J	2 J	190	Kellogg
00D054	Dust	mg/kg	14 J	3 J	590	Kellogg
00D055	Dust	mg/kg	39 J	8 J	790	Kellogg
00D056	Dust	mg/kg	35 J	7 J	720	Kellogg
00D057	Dust	mg/kg	34 J	7 J	500	Kellogg
00D058	Dust	mg/kg	<10 UJ	<1 UJ	49	Kellogg
00D059	Dust	mg/kg	16 J	5 J	300	Kellogg
00D061	Dust	mg/kg	31 J	5 J	720	Kellogg
00D062	Dust	mg/kg	28 J	3 J	220	Page
00D063	Dust	mg/kg	16 J	5 J	360	Kellogg
00D064	Dust	mg/kg	110 J	10 J	11200	Kellogg
00D065	Dust	mg/kg	43 J	3 J	320	Pinehurst
00D066	Dust	mg/kg	99 J	11 J	1600	Pinehurst
00D067	Dust	mg/kg	60 J	13 J	510	Pinehurst
00D068	Dust	mg/kg	44 J	3 J	290	Pinehurst
00D069	Dust	mg/kg	29 J	5 J	210	Pinehurst
00D070	Dust	mg/kg	38 J	3 J	160	Pinehurst
00D071	Dust	mg/kg	45 J	3	250 J	Pinehurst
00D072	Dust	mg/kg	50 J	6	460 J	Pinehurst
00D073	Dust	mg/kg	<10 UJ	2	210 J	Pinehurst
00D074	Dust	mg/kg	58 J	6	400 J	Pinehurst
00D075	Dust	mg/kg	34 J	3	250 J	Pinehurst
00D076	Dust	mg/kg	28 J	3	290 J	Pinehurst
00D077	Dust	mg/kg	43 J	7	590 J	Pinehurst
00D078	Dust	mg/kg	31 J	7	340 J	Pinehurst
00D079	Dust	mg/kg	50 J	8	2300 J	Pinehurst
00D081	Dust	mg/kg	45 J	7	390	Pinehurst
00D082	Dust	mg/kg	51 J	3	270	Pinehurst
00D083	Dust	mg/kg	29 J	3	210	Pinehurst
00D084	Dust	mg/kg	110 J	26	1800	Pinehurst
00D085	Dust	mg/kg	97 J	28	720	Pinehurst
00D086	Dust	mg/kg	21 J	3	210	Pinehurst
00D087	Dust	mg/kg	54 J	6	700	Pinehurst
00D088	Dust	mg/kg	79 J	5	630	Pinehurst
00D089	Dust	mg/kg	35 J	7	600	Kellogg
00D090	Dust	mg/kg	15 J	3	150	Pinehurst

Table 1 - 2000 PHD Vacuum Dust Data (Cont'd)

PHD Lab ID	Matrix	Units	Arsenic Concentration	Cadmium Concentration	Lead Concentration	Location
00D091	Dust	mg/kg	72 J	22	1500 J	Wardner
00D092	Dust	mg/kg	56 J	6	410 J	Pinehurst
00D093	Dust	mg/kg	54 J	3	160 J	Pinehurst
00D094	Dust	mg/kg	71 J	4	300 J	Smelterville
00D095	Dust	mg/kg	37 J	12	1200 J	Kellogg
00D096	Dust	mg/kg	54 J	12	1100 J	Kellogg
00D097	Dust	mg/kg	26 J	5	710 J	Kellogg
00D098	Dust	mg/kg	120 J	6	350 J	Pinehurst
00D099	Dust	mg/kg	13 J	2	180 J	Kellogg
00D101	Dust	mg/kg	29 J	7 J	690	Kellogg
00D102	Dust	mg/kg	31 J	4 J	430	Smelterville

J: Concentration qualified as an estimate
>: Concentration below instrument detection limit
UJ: Concentration below insturment detection and qualified as an estimate

Table 2 - Geochem and U.S. EPA - CLP Duplicate Standards

PHD Lab ID	Analyte	Units	Geochem Value	CLP Value	True Value	Percent Recovery	CLP Percent Recovery
00D020	Arsenic	mg/kg	150	72.5	105	142.9%	69.0%
00D040	Arsenic	mg/kg	140	73.7	105	133.3%	70.2%
00D060	Arsenic	mg/kg	150	73.1	105	142.9%	69.6%
00D080	Arsenic	mg/kg	130	71.5	105	123.8%	68.1%
00D100	Arsenic	mg/kg	160	72.2	105	152.4%	68.8%
00D103	Arsenic	mg/kg	130	72.8	105	123.8%	69.3%
					Average	136.5%	69.2%

PHD Lab ID	Analyte	Units	Geochem Value	CLP Value	True Value	Percent Recovery	CLP Percent Recovery
00D020	Cadmium	mg/kg	32	31.8	41.7	76.7%	76.3%
00D040	Cadmium	mg/kg	33	31.2	41.7	79.1%	74.8%
00D060	Cadmium	mg/kg	34	32.1	41.7	81.5%	77.0%
00D080	Cadmium	mg/kg	34	31.4	41.7	81.5%	75.3%
00D100	Cadmium	mg/kg	35	31.7	41.7	83.9%	76.0%
00D103	Cadmium	mg/kg	33	32.2	41.7	79.1%	77.2%
					Average	80.3%	76.1%

PHD Lab ID	Analyte	Units	Geochem Value	CLP Value	True Value	Percent Recovery	CLP Percent Recovery
00D020	Lead	mg/kg	1000	898	1162	86.1%	77.3%
00D040	Lead	mg/kg	1000	884	1162	86.1%	76.1%
00D060	Lead	mg/kg	1100	904	1162	94.7%	77.8%
00D080	Lead	mg/kg	1100	885	1162	94.7%	76.2%
00D100	Lead	mg/kg	1100	893	1162	94.7%	76.9%
00D103	Lead	mg/kg	1000	908	1162	86.1%	78.1%
					Average	90.4%	77.1%

Percent Recovery = (Found Conc./Known Conc.)* 100

Table 3 - Geochem Prep Blanks

SVL Lab ID	Units	Arsenic Concentration	Cadmium Concentration	Lead Concentration
PB1	mg/kg	<10	<1	<5
PB2	mg/kg	<10	<1	<5
PB3	mg/kg	<10	<1	<5

<: Concentration below instrument detection limit.

Table 4 - Geochem Laboratory Control Samples

SVL Lab ID	Analyte	Units	Measured Value	True Value	Percent Recovery	Acceptable % Range
LCS1	Arsenic	mg/kg	980	930	105.4%	75-120
LCS2	Arsenic	mg/kg	1000	930	107.5%	75-120
LCS3	Arsenic	mg/kg	1200	930	129.0%	75-120
LCS1	Cadmium	mg/kg	31	34	91.2%	75-120
LCS2	Cadmium	mg/kg	32	34	94.1%	75-120
LCS3	Cadmium	mg/kg	35	34	102.9%	75-120
LCS1	Lead	mg/kg	190	226	84.1%	75-120
LCS2	Lead	mg/kg	190	226	84.1%	75-120
LCS3	Lead	mg/kg	220	226	97.3%	75-120

Percent Recovery = (Found Conc./Known Conc.)* 100

Table 5 - Geochem Lab Duplicates

PHD Lab ID	Analyte	Original Concentration	Duplicate Concentration	RPD
00D009	Arsenic	49	44	10.8
00D019	Arsenic	120	97	21.2
00D029	Arsenic	120	100	18.2
00D039	Arsenic	14	<10	NA
00D049	Arsenic	25	22	12.8
00D059	Arsenic	16	16	0.0
00D069	Arsenic	29	25	14.8
00D079	Arsenic	50	47	6.2
00D089	Arsenic	35	42	18.2
00D099	Arsenic	13	13	0.0
			Average	11.3

PHD Lab ID	Analyte	Original Concentration	Duplicate Concentration	RPD
00D009	Cadmium	10	10	0.0
00D019	Cadmium	2	2	0.0
00D029	Cadmium	27	19	34.8
00D039	Cadmium	1	1	0.0
00D049	Cadmium	11	9	20.0
00D059	Cadmium	5	4	22.2
00D069	Cadmium	5	4	22.2
00D079	Cadmium	8	8	0.0
00D089	Cadmium	7	8	13.3
00D099	Cadmium	2	1	66.7
			Average	17.9

PHD Lab ID	Analyte	Original Concentration	Duplicate Concentration	RPD
00D009	Lead	1100	1100	0.0
00D019	Lead	230	230	0.0
00D029	Lead	1300	1200	8.0
00D039	Lead	130	57	78.1
00D049	Lead	990	890	10.6
00D059	Lead	300	270	10.5
00D069	Lead	210	200	4.9
00D079	Lead	2300	1800	24.4
00D089	Lead	600	600	0.0
00D099	Lead	180	120	40.0
			Average	17.7

RPD = ABS(X1-X2)/((X1+X2)/2)
X1 = ORIGINAL SAMPLE
X2 = DUPLICATE SAMPLE
<: Concentration below instrument detection limit.

Table 6 - Geochem and U.S. EPA - CLP Duplicate Concentrations

PHD Lab ID	Analyte	Geochem Concentration	CLP Duplicate Concentration	RPD
00D010	Arsenic	40	27	38.8
00D020	Arsenic	150	72.5	69.7
00D030	Arsenic	73	35.1	70.1
00D040	Arsenic	140	73.7	62.0
00D050	Arsenic	18	7.6	81.3
00D060	Arsenic	150	73.1	68.9
00D070	Arsenic	38	11.8	105.2
00D080	Arsenic	130	71.5	58.1
00D090	Arsenic	15	4.8	103.0
00D100	Arsenic	160	72.2	75.6
00D103	Arsenic	130	72.8	56.4
			Average	71.7

PHD Lab ID	Analyte	Geochem Concentration	CLP Duplicate Concentration	RPD
00D010	Cadmium	6	8.4	33.3
00D020	Cadmium	32	31.8	0.6
00D030	Cadmium	4	4.6	14.0
00D040	Cadmium	33	31.2	5.6
00D050	Cadmium	6	7.8	26.1
00D060	Cadmium	34	32.1	5.7
00D070	Cadmium	3	2.7	10.5
00D080	Cadmium	34	31.4	8.0
00D090	Cadmium	3	2.4	22.2
00D100	Cadmium	35	31.7	9.9
00D103	Cadmium	33	32.2	2.5
			Average	12.6

PHD Lab ID	Analyte	Geochem Concentration	CLP Duplicate Concentration	RPD
00D010	Lead	390	492	23.1
00D020	Lead	1000	898	10.7
00D030	Lead	240	242	0.8
00D040	Lead	1000	884	12.3
00D050	Lead	270	384	34.9
00D060	Lead	1100	904	19.6
00D070	Lead	160	166	3.7
00D080	Lead	1100	885	21.7
00D090	Lead	150	154	2.6
00D100	Lead	1100	893	20.8
00D103	Lead	1000	908	9.6
			Average	14.5

RPD = ABS(X1-X2)/((X1+X2)/2)

X1 = ORIGINAL SAMPLE

X2 = DUPLICATE SAMPLE

<: Concentration below instrument detection limit.

Table 7A - U.S. EPA - CLP Duplicate QA/QC Data - Laboratory Control Samples

SVL Lab ID	Analyte	Units	Measured Value	True Value	Percent Recovery	Acceptable % Range
LCSO	Arsenic	mg/kg	71.8	75.2	95.5%	75-120
LCSO	Cadmium	mg/kg	175.5	181	97.0%	75-120
LCSO	Lead	mg/kg	53.8	56.8	94.7%	75-120
				Average	95.7%	75-120

Table 7B - U.S. EPA - CLP Duplicate QA/QC Data - Laboratory Duplicates

SVL Lab ID	PHD Lab ID	Analyte	Units	Original Concentration	Duplicate Concentration	RPD
O243943D	00D010	Arsenic	mg/kg	26.9	26.3	2.3
O243943D	00D010	Cadmium	mg/kg	8.4	8.0	5.5
O243943D	00D010	Lead	mg/kg	492.5	499.0	1.3
					Average	3.0

Table 7C - U.S. EPA - CLP Duplicate QA/QC Data - Laboratory Matrix Spikes

PHD Lab ID	Analyte	Units	Original Concentration	Spike Added	Matrix Spike Concentration	Percent Recovery
00D010	Arsenic	mg/kg	27.0	100	117.5	90.5%
00D103	Arsenic	mg/kg	72.8	100	151.2	78.4%
00D010	Cadmium	mg/kg	8.4	100	98.5	90.1%
00D103	Cadmium	mg/kg	32.2	100	111.5	79.3%
00D010	Lead	mg/kg	492.5	100	573.0	80.5%
00D103	Lead	mg/kg	908.0	100	991.7	83.7%
					Average % R	83.7%

Percent Recovery = (Found Conc.)/Known Conc.)* 100

RPD = ABS(X1-X2)/((X1+X2)/2)
X1 = ORIGINAL SAMPLE
X2 = DUPLICATE SAMPLE

121 South Jackson Street
Moscow, Idaho 83843
Phone: 208-882-7858
Fax: 208-883-3785
108 West Idaho Street
Kellogg, Idaho 83837
Phone: 208-786-1206
Fax: 208-786-1209
http:/ / www.tgenviro.com
office@tgenviro.com

INTERNAL MEMORANDUM

To: Gerald B. Lee, TerraGraphics, Moscow

From: Shanda LeVan, TerraGraphics, Moscow

Date: January 19, 2001

Subject: QA/QC Review for the 2000 TerraGraphics Vacuum Dust Data

Introduction

The following memorandum summarizes the quality assurance/quality control (QA/QC) review for the 2000 TerraGraphics vacuum dust data. Sample data was collected from the towns of Kellogg, Page, Pinehurst, Smelterville, and Wardner. The vacuum dust sampling event occurred from July 17 through August 30, 2000.

General

A QA/QC review was done to evaluate the precision, accuracy, completeness, and representativeness of the data obtained from both the field and the laboratory. Definitions and QC objectives for these parameters are described in the *2000 FINAL Field Work Plan for Interior Dust Sampling* (TerraGraphics 2000). Procedures for sample labeling, handling, and analysis were as described in the work plan. All laboratory data and master logs were entered into Microsoft Excel spreadsheet and dBase 5.0 database files. These along with chain of custody forms were reviewed to ensure that samples were labeled and tracked correctly. All samples were sent to Northern Analytical Laboratories, Inc. in Billings, Montana for analysis. This data validation review indicated all samples were properly labeled and tracked. All sample holding times were met. Data appear in Table 1.

Field Sampling QA/QC Results

A total of 217 samples (including QA/QC) vacuum samples were collected from homes in the area. Field QA/QC consisted of duplicate samples and National Institute of Standards and Technology (NIST) standards inserted into the sample train.

Duplicates

Vacuum dust field duplicates consisted of a second sample collected from the vacuum cleaner bag in the same manner as the original. Duplicate samples were used to examine variability in field and laboratory procedures. Twelve duplicate samples (approximately 1 in 20) were collected in the field and submitted to the laboratory for analysis.

Results for the field duplicate analyses are presented in Table 2. The relative percent difference (RPD) for the duplicates ranged from 0.0% to 23.8%, with an average of 7.4%. All RPDs were within acceptable ranges and no qualifiers were placed on the data based on field duplicate results.

Laboratory Analysis

A total of 193 samples (excluding QA/QC) were submitted to Northern Analytical and analyzed for total lead. Laboratory QA/QC was checked externally by duplicate samples (see above) and NIST standards submitted blind. Northern Analytical provided a copy of their internal QA/QC results for blanks, aqueous and soil laboratory control samples (LCS), and matrix spike/matrix spike duplicate analyses (MS/MSD).

External QA/QC

An external check for accuracy of laboratory analyses was assessed using soil standards. Twelve NIST standards (approximately 1 in 20) containing 1162 mg/kg lead were submitted blind to Northern Analytical. Percent recoveries ranged from 83.3% to 101.5%, with an average of 91.4%. No qualifiers were placed on the data based on percent recovery results. Standard results are presented in Table 3.

Internal QA/QC

Northern Analytical analyzed a total of twelve prep blanks to ensure no bias was introduced during sample preparation. All prep blanks were below the instrument detection limits. No qualifiers were placed on the data based on Northern Analytical’s prep blank results.

Internal checks of Northern Analytical’s accuracy were assessed by analyzing twelve each of aqueous and soil laboratory control samples (LCS). Results are presented in Tables 4 and 5. All LCS displayed acceptable percent recoveries and/or were within the acceptable range specified by Northern Analytical.

Internal checks of laboratory precision at Northern Analytical were assessed using matrix spike/matrix spike duplicates (MS/MSD). MS/MSD were analyzed on twelve of the 217 samples (approximately 1 in 20). Results for the samples are presented in Table 6. Calculated RPD values for the MS/MSD samples ranged from 0.0% to 9.5%, with an average of 3.9%. All spike percent recoveries, provided by Northern Analytical, were within acceptable limits, except for the MSD sample analyzed in Sample Delivery Group (SDG) # 2000070328. In this case, the sample result was greater than four times the spike added, therefore no corrective action was required. No qualifiers were placed on the data based on the laboratory MS/MSD results.

Conclusions

An external check of Northern Analytical laboratory accuracy was assessed using NIST soil standards. All percent recoveries were within the acceptable range and no qualifiers were placed on the data. An external check of laboratory procedures and field variability was assessed using duplicate samples. All RPDs were within acceptable limits.

An internal check of Northern Analytical laboratory accuracy was assessed using aqueous and soil LCS. All LCS results were within acceptable limits.   Laboratory precision was assessed using matrix spike/matrix spike duplicate analyses. All matrix spike/matrix spike duplicates displayed acceptable RPD values. Lead concentrations in all laboratory prep blanks were below the detection limit.

Based on a complete review of the field duplicates, NIST standards, prep blanks, aqueous and soil LCS, and matrix spike/matrix spike duplicate analyses, the final completeness for the study was assessed at 100%.

Table 1 - 2000 TerraGraphics Vacuum Dust Data

Lab ID	Sample ID	Matrix	Units	Lead Concentration	Location
2000070330-18	00V039	Dust	mg/kg	1280	KELLOGG
2000070330-19	00V040	Dust	mg/kg	560	KELLOGG
2000070325-2	00V043	Dust	mg/kg	305	KELLOGG
2000070325-8	00V049	Dust	mg/kg	331	KELLOGG
2000070325-13	00V054	Dust	mg/kg	2490	KELLOGG
2000070325-14	00V055	Dust	mg/kg	509	KELLOGG
2000070325-15	00V056	Dust	mg/kg	346	KELLOGG
2000070325-16	00V057	Dust	mg/kg	228	KELLOGG
2000070325-17	00V058	Dust	mg/kg	586	KELLOGG
2000070325-18	00V059	Dust	mg/kg	488	KELLOGG
2000070325-19	00V060	Dust	mg/kg	403	KELLOGG
2000070331-1	00V062	Dust	mg/kg	212	KELLOGG
2000070331-2	00V063	Dust	mg/kg	2290	KELLOGG
2000070331-3	00V064	Dust	mg/kg	1360	KELLOGG
2000070331-4	00V065	Dust	mg/kg	637	KELLOGG
2000070331-5	00V066	Dust	mg/kg	928	KELLOGG
2000070331-6	00V067	Dust	mg/kg	482	KELLOGG
2000070331-7	00V068	Dust	mg/kg	203	KELLOGG
2000070331-8	00V069	Dust	mg/kg	826	KELLOGG
2000070331-10	00V071	Dust	mg/kg	710	KELLOGG
2000070331-11	00V072	Dust	mg/kg	801	KELLOGG
2000070331-12	00V073	Dust	mg/kg	666	KELLOGG
2000070331-13	00V074	Dust	mg/kg	655	KELLOGG
2000070331-14	00V075	Dust	mg/kg	37	KELLOGG
2000070331-15	00V076	Dust	mg/kg	881	KELLOGG
2000070331-16	00V077	Dust	mg/kg	601	KELLOGG
2000070331-17	00V078	Dust	mg/kg	132	KELLOGG
2000070331-18	00V079	Dust	mg/kg	298	KELLOGG
2000070329-7	00V088	Dust	mg/kg	116	KELLOGG
2000070329-8	00V089	Dust	mg/kg	475	KELLOGG
2000070329-10	00V091	Dust	mg/kg	2530	KELLOGG
2000070329-11	00V092	Dust	mg/kg	199	KELLOGG
2000070329-12	00V093	Dust	mg/kg	292	KELLOGG
2000070329-13	00V094	Dust	mg/kg	909	KELLOGG
2000070329-14	00V095	Dust	mg/kg	1050	KELLOGG
2000070329-15	00V096	Dust	mg/kg	132	KELLOGG
2000070329-16	00V097	Dust	mg/kg	760	KELLOGG
2000070329-17	00V098	Dust	mg/kg	560	KELLOGG
2000070329-18	00V099	Dust	mg/kg	328	KELLOGG
2000070329-19	00V100	Dust	mg/kg	937	KELLOGG
2000070327-1	00V102	Dust	mg/kg	1540	KELLOGG
2000070327-2	00V103	Dust	mg/kg	3720	KELLOGG
2000070327-3	00V104	Dust	mg/kg	1020	KELLOGG
2000070327-4	00V105	Dust	mg/kg	523	KELLOGG
2000070327-5	00V106	Dust	mg/kg	1150	KELLOGG

Table 1 - 2000 TerraGraphics Vacuum Dust Data (Cont'd)

Lab ID	Sample ID	Matrix	Units	Lead Concentration	Location
2000070327-7	00V108	Dust	mg/kg	509	KELLOGG
2000070327-8	00V109	Dust	mg/kg	389	KELLOGG
2000070327-10	00V111	Dust	mg/kg	412	KELLOGG
2000070327-11	00V112	Dust	mg/kg	540	KELLOGG
2000070327-12	00V113	Dust	mg/kg	340	KELLOGG
2000070327-13	00V114	Dust	mg/kg	1120	KELLOGG
2000070327-14	00V115	Dust	mg/kg	498	KELLOGG
2000070327-15	00V116	Dust	mg/kg	322	KELLOGG
2000070327-16	00V117	Dust	mg/kg	474	KELLOGG
2000070327-17	00V118	Dust	mg/kg	499	KELLOGG
2000070327-18	00V119	Dust	mg/kg	1810	KELLOGG
2000070327-19	00V120	Dust	mg/kg	555	KELLOGG
2000070326-1	00V122	Dust	mg/kg	460	KELLOGG
2000070326-2	00V123	Dust	mg/kg	245	KELLOGG
2000070326-3	00V124	Dust	mg/kg	704	KELLOGG
2000070326-4	00V125	Dust	mg/kg	356	KELLOGG
2000070326-5	00V126	Dust	mg/kg	1250	KELLOGG
2000070326-6	00V127	Dust	mg/kg	207	KELLOGG
2000070326-7	00V128	Dust	mg/kg	447	KELLOGG
2000070326-8	00V129	Dust	mg/kg	1400	KELLOGG
2000070326-10	00V131	Dust	mg/kg	467	KELLOGG
2000070326-11	00V132	Dust	mg/kg	1370	KELLOGG
2000070326-12	00V133	Dust	mg/kg	155	KELLOGG
2000070326-13	00V134	Dust	mg/kg	149	KELLOGG
2000070326-14	00V135	Dust	mg/kg	448	KELLOGG
2000070326-15	00V136	Dust	mg/kg	774	KELLOGG
2000070326-16	00V137	Dust	mg/kg	1060	KELLOGG
2000070326-17	00V138	Dust	mg/kg	1260	KELLOGG
2000070326-18	00V139	Dust	mg/kg	237	KELLOGG
2000070326-19	00V140	Dust	mg/kg	697	KELLOGG
2000080016-1	00V142	Dust	mg/kg	504	KELLOGG
2000080016-2	00V143	Dust	mg/kg	516	KELLOGG
2000080016-8	00V149	Dust	mg/kg	194	KELLOGG
2000080017-9	00V169	Dust	mg/kg	1940	KELLOGG
2000080017-11	00V171	Dust	mg/kg	525	KELLOGG
2000080017-12	00V172	Dust	mg/kg	232	KELLOGG
2000080017-14	00V174	Dust	mg/kg	115	KELLOGG
2000080017-16	00V176	Dust	mg/kg	1930	KELLOGG
2000080017-17	00V177	Dust	mg/kg	1080	KELLOGG
2000080017-18	00V178	Dust	mg/kg	711	KELLOGG
2000080017-19	00V179	Dust	mg/kg	1130	KELLOGG
2000080018-1	00V181	Dust	mg/kg	672	KELLOGG
2000090044-11	00V196	Dust	mg/kg	718	KELLOGG
2000090044-12	00V197	Dust	mg/kg	730	KELLOGG
2000090044-13	00V198	Dust	mg/kg	745	KELLOGG

Table 1 - 2000 TerraGraphics Vacuum Dust Data (Cont'd)

Lab ID	Sample ID	Matrix	Units	Lead Concentration	Location
2000090044-16	00V201	Dust	mg/kg	411	KELLOGG
2000090044-17	00V202	Dust	mg/kg	1360	KELLOGG
2000090044-18	00V203	Dust	mg/kg	1560	KELLOGG
2000090044-19	00V204	Dust	mg/kg	466	KELLOGG
2000090044-20	00V205	Dust	mg/kg	914	KELLOGG
2000090045-1	00V206	Dust	mg/kg	822	KELLOGG
2000090045-2	00V207	Dust	mg/kg	1230	KELLOGG
2000090045-3	00V208	Dust	mg/kg	1230	KELLOGG
2000090045-4	00V209	Dust	mg/kg	692	KELLOGG
2000090045-5	00V210	Dust	mg/kg	464	KELLOGG
2000090045-7	00V212	Dust	mg/kg	803	KELLOGG
2000090045-8	00V213	Dust	mg/kg	130	KELLOGG
2000090045-9	00V214	Dust	mg/kg	529	KELLOGG
2000070331-19	00V080	Dust	mg/kg	941	PAGE
2000070329-1	00V082	Dust	mg/kg	451	PAGE
2000070329-2	00V083	Dust	mg/kg	777	PAGE
2000080016-3	00V144	Dust	mg/kg	305	PINEHURST
2000080016-4	00V145	Dust	mg/kg	418	PINEHURST
2000080016-5	00V146	Dust	mg/kg	358	PINEHURST
2000080016-6	00V147	Dust	mg/kg	837	PINEHURST
2000080016-7	00V148	Dust	mg/kg	495	PINEHURST
2000080016-10	00V151	Dust	mg/kg	869	PINEHURST
2000080016-11	00V152	Dust	mg/kg	217	PINEHURST
2000080016-12	00V153	Dust	mg/kg	202	PINEHURST
2000080016-13	00V154	Dust	mg/kg	523	PINEHURST
2000080016-14	00V155	Dust	mg/kg	513	PINEHURST
2000080016-15	00V156	Dust	mg/kg	417	PINEHURST
2000080016-16	00V157	Dust	mg/kg	298	PINEHURST
2000080016-17	00V158	Dust	mg/kg	283	PINEHURST
2000080016-18	00V159	Dust	mg/kg	591	PINEHURST
2000080016-19	00V160	Dust	mg/kg	217	PINEHURST
2000080017-2	00V162	Dust	mg/kg	145	PINEHURST
2000080017-3	00V163	Dust	mg/kg	279	PINEHURST
2000080017-4	00V164	Dust	mg/kg	456	PINEHURST
2000080017-5	00V165	Dust	mg/kg	1300	PINEHURST
2000080017-6	00V166	Dust	mg/kg	697	PINEHURST
2000080017-7	00V167	Dust	mg/kg	2640	PINEHURST
2000080017-8	00V168	Dust	mg/kg	542	PINEHURST
2000080017-13	00V173	Dust	mg/kg	590	PINEHURST
2000080017-15	00V175	Dust	mg/kg	568	PINEHURST
2000080018-2	00V182	Dust	mg/kg	370	PINEHURST
2000080018-3	00V183	Dust	mg/kg	377	PINEHURST
2000090044-14	00V199	Dust	mg/kg	690	PINEHURST
2000090045-6	00V211	Dust	mg/kg	40	PINEHURST
2000080017-1	00V001	Dust	mg/kg	430	SMELTERVILLE

Table 1 - 2000 TerraGraphics Vacuum Dust Data (Cont'd)

Lab ID	Sample ID	Matrix	Units	Lead Concentration	Location
2000070328-1	00V002	Dust	mg/kg	2160	SMELTERVILLE
2000070328-2	00V003	Dust	mg/kg	1050	SMELTERVILLE
2000070328-3	00V004	Dust	mg/kg	398	SMELTERVILLE
2000070328-4	00V005	Dust	mg/kg	267	SMELTERVILLE
2000070328-5	00V006	Dust	mg/kg	177	SMELTERVILLE
2000070328-6	00V007	Dust	mg/kg	910	SMELTERVILLE
2000070328-7	00V008	Dust	mg/kg	226	SMELTERVILLE
2000070328-8	00V009	Dust	mg/kg	1130	SMELTERVILLE
2000070328-10	00V011	Dust	mg/kg	904	SMELTERVILLE
2000070328-11	00V012	Dust	mg/kg	651	SMELTERVILLE
2000070328-12	00V013	Dust	mg/kg	1290	SMELTERVILLE
2000070328-13	00V014	Dust	mg/kg	732	SMELTERVILLE
2000070328-14	00V015	Dust	mg/kg	963	SMELTERVILLE
2000070328-15	00V016	Dust	mg/kg	252	SMELTERVILLE
2000070328-16	00V017	Dust	mg/kg	145	SMELTERVILLE
2000070328-17	00V018	Dust	mg/kg	175	SMELTERVILLE
2000070328-18	00V019	Dust	mg/kg	109	SMELTERVILLE
2000070328-19	00V020	Dust	mg/kg	38	SMELTERVILLE
2000070330-1	00V022	Dust	mg/kg	149	SMELTERVILLE
2000070330-2	00V023	Dust	mg/kg	680	SMELTERVILLE
2000070330-3	00V024	Dust	mg/kg	282	SMELTERVILLE
2000070330-4	00V025	Dust	mg/kg	437	SMELTERVILLE
2000070330-5	00V026	Dust	mg/kg	190	SMELTERVILLE
2000070330-6	00V027	Dust	mg/kg	330	SMELTERVILLE
2000070330-7	00V028	Dust	mg/kg	968	SMELTERVILLE
2000070330-8	00V029	Dust	mg/kg	454	SMELTERVILLE
2000070330-10	00V031	Dust	mg/kg	1470	SMELTERVILLE
2000070330-11	00V032	Dust	mg/kg	242	SMELTERVILLE
2000070330-12	00V033	Dust	mg/kg	119	SMELTERVILLE
2000070330-17	00V038	Dust	mg/kg	1230	SMELTERVILLE
2000070325-1	00V042	Dust	mg/kg	406	SMELTERVILLE
2000070325-3	00V044	Dust	mg/kg	474	SMELTERVILLE
2000070325-4	00V045	Dust	mg/kg	501	SMELTERVILLE
2000070325-5	00V046	Dust	mg/kg	73	SMELTERVILLE
2000070325-6	00V047	Dust	mg/kg	30900	SMELTERVILLE
2000070325-7	00V048	Dust	mg/kg	310	SMELTERVILLE
2000070325-10	00V051	Dust	mg/kg	721	SMELTERVILLE
2000070325-11	00V052	Dust	mg/kg	2350	SMELTERVILLE
2000070325-12	00V053	Dust	mg/kg	474	SMELTERVILLE
2000090044-1	00V186	Dust	mg/kg	170	SMELTERVILLE
2000090044-2	00V187	Dust	mg/kg	246	SMELTERVILLE
2000090044-3	00V188	Dust	mg/kg	846	SMELTERVILLE
2000090044-5	00V190	Dust	mg/kg	983	SMELTERVILLE
2000090044-6	00V191	Dust	mg/kg	2100	SMELTERVILLE
2000090044-7	00V192	Dust	mg/kg	223	SMELTERVILLE

Table 1 - 2000 TerraGraphics Vacuum Dust Data (Cont'd)

Lab ID	Sample ID	Matrix	Units	Lead Concentration	Location
2000090044-8	00V193	Dust	mg/kg	2310	SMELTERVILLE
2000090044-9	00V194	Dust	mg/kg	2280	SMELTERVILLE
2000090044-10	00V195	Dust	mg/kg	224	SMELTERVILLE
2000070330-13	00V034	Dust	mg/kg	330	WARDNER
2000070330-14	00V035	Dust	mg/kg	1580	WARDNER
2000070330-15	00V036	Dust	mg/kg	473	WARDNER
2000070330-16	00V037	Dust	mg/kg	2700	WARDNER
2000070329-3	00V084	Dust	mg/kg	992	WARDNER
2000070329-4	00V085	Dust	mg/kg	385	WARDNER
2000070329-5	00V086	Dust	mg/kg	650	WARDNER
2000070329-6	00V087	Dust	mg/kg	747	WARDNER
2000070327-6	00V107	Dust	mg/kg	979	WARDNER
2000090045-11	00V216	Dust	mg/kg	503	WARDNER

Table 2 - Field Duplicates

Original Lab ID	Duplicate Lab ID	Original Sample ID	Duplicate Sample ID	Units	Original Lead Conc.	Duplicate Lead Conc.	RPD
2000070328-19	2000070328-20	00V020	00V021	mg/kg	38	38	0.0
2000070330-19	2000070330-20	00V040	00V041	mg/kg	560	554	1.1
2000070325-19	2000070325-20	00V060	00V061	mg/kg	403	457	12.6
2000070331-19	2000070331-20	00V080	00V081	mg/kg	941	906	3.8
2000070329-19	2000070329-20	00V100	00V101	mg/kg	937	1190	23.8
2000070327-19	2000070327-20	00V120	00V121	mg/kg	555	583	4.9
2000070326-19	2000070326-20	00V140	00V141	mg/kg	697	648	7.3
2000080016-19	2000080016-20	00V160	00V161	mg/kg	217	227	4.5
2000080017-19	2000080017-20	00V179	00V180	mg/kg	1130	954	16.9
2000080018-3	2000080018-4	00V183	00V184	mg/kg	377	400	5.9
2000090044-14	2000090044-15	00V199	00V200	mg/kg	690	733	6.0
2000090045-11	2000090045-12	00V216	00V217	mg/kg	503	515	2.4
						Average	7.4

RPD = ABS(X1-X2)/((X1+X2)/2)

X1 = ORIGINAL SAMPLE

X2 = DUPLICATE SAMPLE

Table 3 - Standards

Sample ID	Analyte	Measured Value (mg/kg)	True Value (mg/kg)	Percent Recovery
00V010	Lead	1050	1162	90.4%
00V030	Lead	968	1162	83.3%
00V050	Lead	1120	1162	96.4%
00V070	Lead	973	1162	83.7%
00V090	Lead	1090	1162	93.8%
00V110	Lead	1000	1162	86.1%
00V130	Lead	1050	1162	90.4%
00V150	Lead	1120	1162	96.4%
00V170	Lead	1180	1162	101.5%
00V185	Lead	1100	1162	94.7%
00V189	Lead	1060	1162	91.2%
00V215	Lead	1040	1162	89.5%
			Average	91.4%

Percent Recovery = (Measured Conc.)/(True Conc.)* 100

Table 4 - Aqueous LCS

Lab ID	Measured Value (mg/L)	True Value (mg/L)	Percent Recovery	Acceptable % Range*
2000070328-22	5.14	5.00	102.8%	80-120
2000070330-22	5.30	5.00	106.0%	80-120
2000070325-22	4.89	5.00	97.8%	80-120
2000070331-22	5.13	5.00	102.6%	80-120
2000070329-22	4.83	5.00	96.6%	80-120
2000070327-22	4.85	5.00	97.0%	80-120
2000070326-22	5.12	5.00	102.4%	80-120
2000080016-22	5.48	5.00	109.6%	80-120
2000080017-22	4.97	5.00	99.4%	80-120
2000080018-7	5.03	5.00	100.6%	80-120
2000090044-22	5.21	5.00	104.2%	80-120
2000090045-14	5.08	5.00	101.6%	80-120

Percent Recovery = (Measured Conc.)/(True Conc.)* 100
*Acceptable percent recovery range specifiec by Northern Analytical, Inc.

Table 5 - Soil LCS

Sample ID	Measured Value (mg/kg)	True Value (mg/kg)	Percent Recovery	Acceptable % Range
2000070328-23	609	569	107.0%	79-121
2000070330-23	1460	1380	105.8%	81-119
2000070325-23	802	803.2	99.9%	79-121
2000070331-23	1340	1380	97.1%	81-119
2000070329-23	585	587	99.7%	79-121
2000070327-23	592	587	100.9%	79-121
2000070326-23	852	803.2	106.1%	79-121
2000080016-23	1451	1380	105.1%	81-119
2000080017-23	1400	1380	101.4%	81-119
2000080018-7	183	197	92.9%	74-126
2000090044-23	1570	1392	112.8%	84-116
2000090045-15	1480	1392	106.3%	84-116

Percent Recovery = (Measured Conc.)/(True Conc.)* 100
*Acceptable percent recovery range specifiec by Northern Analytical, Inc.

Table 6 - Laboratory Matrix Spike/Matrix Spike Duplicates

MS Lab ID	MS/D Lab ID	Units	MS Concentration	MS/D Concentration	RPD
2000070328-24	2000070328-25	mg/kg	2730	2860	4.7
2000070330-24	2000070330-25	mg/kg	626	675	7.5
2000070325-24	2000070325-25	mg/kg	812	829	2.1
2000070331-24	2000070331-25	mg/kg	2770	2740	1.1
2000070329-24	2000070329-25	mg/kg	936	878	6.4
2000070327-24	2000070327-25	mg/kg	2050	1970	4.0
2000070326-24	2000070326-25	mg/kg	848	933	9.5
2000080016-24	2000080016-25	mg/kg	943	1000	5.9
2000080017-24	2000080017-25	mg/kg	917	950	3.5
2000080018-9	2000080018-10	mg/kg	1150	1150	0.0
2000090044-24	2000090044-25	mg/kg	648	646	0.3
2000090045-16	2000090045-17	mg/kg	1280	1300	1.6
				Average RPD	3.9

RPD = ABS(X1-X2)/((X1+X2)/2)
X1 = ORIGINAL SAMPLE
X2 = DUPLICATE SAMPLE

TerraGraphics
ENVIRONMENTAL ENGINEERING, INC

121 South Jackson Street
Moscow, Idaho 83843
Phone: 208-882-7858
Fax: 208-883-3785

108 West Idaho Street
Kellogg, Idaho 83837
Phone: 208-786-1206
Fax: 208-786-1209
http:/ / www.tgenviro.com
office@tgenviro.com

INTERNAL MEMORANDUM

To: Jerry Lee, TerraGraphics

From: Shanda LeVan, TerraGraphics

Date: March 16, 2001

Subject: QA/QC Review for 2000 TerraGraphics and Panhandle Health District Dust Mat Sampling

---

Introduction

The following memorandum provides a summary of the quality assurance/quality control (QA/QC) review for the 2000 TerraGraphics and Panhandle Health District (PHD) dust mat sampling in Kellogg, Smelterville, Wardner, Page, and Pinehurst.

General

A QA/QC review was completed to evaluate the precision, accuracy, completeness, and representativeness of the data obtained from both the field and the laboratory. Definitions and QC objectives for these parameters are described in the *2000 FINAL Field Work Plan for Interior Dust Sampling* (TerraGraphics 2000). Procedures for sample labeling, handling, and analysis were as described in the Work Plan. All laboratory data and master logs were entered into dBase 5.0 database files and checked to ensure that samples were labeled and tracked correctly. Chain of custody forms were reviewed. All sample holding times were met. Dust mat data are shown in Table 1.

Forty samples (including three duplicates) contained insufficient volumes, and were not analyzed. Thirty-one samples (including three standards and one duplicate) were rejected based on the QA/QC review. Twenty of these samples, all of laboratory batch 2000090298, were rejected because two or more samples were mis-labeled in the field, and correct sample identification could not be determined. Ten samples from laboratory batch 2000100051 were rejected due to a sample identification problem during laboratory analysis. This batch was re-analyzed and values were duplicated for six of the first eight samples and for two samples towards the end of the batch. We determined that values were duplicated when the Relative Percent Difference (RPD) between the first value and the re-analysis value was below 20%. Two of the first eight samples could not be re-analyzed due to insufficient volume, however, because results for all samples surrounding these two samples were confirmed, these two sample results were not rejected. One standard from laboratory batch 2000090299 was rejected because an undetermined amount of standard was applied to the mat. Rejected dust mat results are shown in Table 2.

Eighty-one samples were qualified as estimates for the calculated loading portion of the study based on residents' answers to the questionnaire given upon retrieval of the dust mats. Loading calculations for 7 samples were considered estimates because the residents indicated that they were gone from the home 10 or more days. Four dust mat samples had been vacuumed by the resident at least once, 19 samples had been moved from one location to another, and 32 dust mats had been shaken out one or more times. Nineteen dust mat samples had a combination of two or more of the above. In all of these cases the loading calculations were qualified as estimates.

Field Sampling QA/QC Results

A total of 427 dust mat samples (including QA/QC) were collected and analyzed. Not including QA/QC, 183 were from TerraGraphics-placed mats and 196 were from PHD dust mats. Samples were taken from homes in Smelterville, Kellogg, Wardner, Page, and Pinehurst. All dust mat samples were analyzed for total lead by Northern Analytical Laboratories, Inc. in Billings, Montana. Field QA/QC samples consisted of 22 standards and 20 field duplicates. Six rinsate blanks were also collected. All samples were banked and recorded on a master log, and chain of custody forms were completed and checked before samples were shipped to the lab. All samples were sieved to -80 mesh at Northern Analytical prior to analysis.

Field Duplicates

Field duplicates consisted of a second dust mat being placed directly next to the original dust mat. Duplicate samples were used to examine variability in the field and in laboratory procedures. A total of 20 duplicates were collected in the field and submitted to the laboratory for analysis. Field duplicates were collected at a rate of approximately one duplicate for every 19 samples.

Results for 19 of the 20 duplicate analyses are presented in Table 3. One duplicate was rejected due to an error in sample labeling (see above). The calculated relative percent difference (RPD) ranged from 0.5% to 60.8%, with an average of 18.4%. The degree of variability is consistent with earlier dust mat sampling programs. Three of the duplicate mats and two of the original mats yielded insufficient sample volume and were not analyzed.

Rinsate Blanks

Rinsate blanks were collected to ensure decontamination procedures were effective, and that cross-contamination was not significant during field sampling. Rinsate blanks consisted of commercially available distilled water poured over a representative batch of decontaminated sampling equipment. Rinsate blanks were collected into 500 ml plastic bottles and preserved

with nitric acid. The bottles were supplied by Northern Analytical and were delivered to Northern Analytical for analysis.

Six rinsate blanks were collected during the sampling event. Rinsate blank results are presented in Table 4. Five of six rinsate blanks were below detection for lead. Rinsate blank with sample identification number 00M369 had a lead concentration of 0.003 mg/l. The lowest dust mat lead concentration detected was 70 mg/kg. This concentration is significantly higher than 10 times the rinsate concentration; therefore, it was determined that decontamination procedures were adequate for the project and no qualifiers were placed on the data.

Laboratory Analysis

A total of 379 samples (excluding QA/QC samples) were collected from dust mats during the project. Laboratory QA/QC was checked externally by the use of duplicate samples in the field and by submitting soil standards blind to the laboratory for lead analysis. Northern Analytical provided a copy of their internal QA/QC results for blanks, laboratory control samples (LCS), and matrix spike/matrix spike duplicates (MS/MSD).

External QA/QC

A pre-loaded mat standard was inserted at the University of Idaho vacuum lab for approximately every 17th dust mat sample collected. A total of 22 standards were recovered from the mats and submitted blind to Northern Analytical. Pre-loaded mats had 10 g of a NIST standard containing 1162 mg/kg lead. One mat received an undetermined amount of standard and was rejected. Two standards were rejected based on sample mis-labeling as described above. The standards were used to evaluate the dust recovery of the vacuum, as well as the accuracy of Northern Analytical. The average percent recovery by dust mass for the standards was 84%. The average percent recovery by concentration was 66%. The average percent recovery on lead mass was 55%. Standard dust mass, lead concentration, and lead mass percent recovery results are presented in Tables 5a-c.

As was the case in the 1997 through 1999 studies, standard percent recoveries on dust mass, lead concentration, and lead mass were low. The sieved portion of many of the dust mat samples in previous projects contained significant amounts of fibers. Numerous mat fibers were clearly visible in 1997 and 1998 laboratory photographs of the sieved portion of the samples. Another possible explanation for the decreased percent recovery on concentration is preferential retention of the clays on the somewhat sticky vinyl surface, thereby reducing the total amount of lead available for vacuum sample removal. No qualifiers were placed on the data based on the mat dust standard results.

Internal QA/QC

Northern Analytical inserted one prep blank per batch of samples to ensure no bias was introduced during sample preparation. All blanks were below the instrument detection limit. See Table 6. No qualifiers were placed on the data based on the prep blank results.

Internal checks of Northern Analytical's accuracy were assessed by analyzing one soil and one aqueous laboratory control sample (LCS) per batch, for a total of 46 LCS. Results for aqueous LCS are presented in Table 7. Results for soil LCS are presented in Table 8. All LCS samples were within the acceptable range specified by Northern Analytical. No qualifiers were placed on the data based on the LCS results.

Internal checks of laboratory precision at Northern Analytical were assessed using matrix spike/matrix spike duplicate (MS/MSD) analysis on 23 of the 427 samples submitted for analysis. Results are presented in Table 9. RPDs ranged from 0.0% to 13.7%, with an average of 3.3%. No qualifiers were placed on the data based on the laboratory MS/MSD results.

Conclusions

A total of 40 samples (including three duplicates) contained insufficient volumes, and were not analyzed. Thirty-one samples (including three standards and one duplicate) were rejected based on the QA/QC review. Twenty of these samples, all of laboratory batch 2000090298, were rejected because two or more samples were mis-labeled in the field, and correct sample identification could not be determined. Ten samples from laboratory batch 2000100051 were rejected due to a sample identification problem during laboratory analysis. One standard from laboratory batch 2000090299 was rejected because an undetermined amount of standard was applied to the mat.

Eighty-one samples were qualified as estimates, for the calculated loading portion of the study, based on residents' answers to the questionnaire given upon retrieval of the dust mats.

Field and lab variability was assessed using duplicate samples. Analysis of dust mat duplicates indicates relatively high variability which is attributable to the procedure.

An external check of Northern Analytical lab accuracy was determined using soil standards of known concentration inserted blind with the field samples. Percent recoveries were low for many of the NIST standard samples. These low percent recoveries were likely a result of fiber dilution of vacuum samples or a portion of the standard sticking to the vinyl surface. No qualifiers were placed on the data based on NIST standard results.

An internal check of Northern Analytical laboratory accuracy was assessed using aqueous and soil LCS. All results were within the specified limits. Laboratory precision was assessed using MS/MSD analyses. All MS/MSD displayed acceptable RPD values. All laboratory blanks were below the detection limit.

Based on a complete review of the field duplicates, standards, LCS, prep blanks, and Northern Analytical MS/MSD analyses, the final completeness for the study was assessed at 93%.

Table 1 - 2000 Panhandle Health District and TerraGraphics' Combined Dust Mat Data

Lab ID	Sample ID	Type	Lead Concentration	Units	Location
2000090299 - 1	00M022	Dust	407	mg/kg	KELLOGG
2000090299 - 3	00M024	Dust	1680	mg/kg	KELLOGG
2000090299 - 4	00M025	Dust	938	mg/kg	KELLOGG
2000090299 - 5	00M026	Dust	650	mg/kg	KELLOGG
2000090299 - 6	00M027	Dust	521	mg/kg	KELLOGG
2000090299 - 7	00M028	Dust	515	mg/kg	KELLOGG
2000090299 - 8	00M029	Dust	552	mg/kg	KELLOGG
2000090299 - 9	00M030	Dust	198	mg/kg	KELLOGG
2000090299 - 11	00M032	Dust	260	mg/kg	KELLOGG
2000090299 - 18	00M039	Dust	insufficient volume*		KELLOGG
2000090299 - 19	00M040	Dust	1080	mg/kg	KELLOGG
2000090300 - 2	00M043	Dust	771	mg/kg	KELLOGG
2000090300 - 3	00M044	Dust	1060	mg/kg	KELLOGG
2000090300 - 4	00M045	Dust	insufficient volume*		KELLOGG
2000090300 - 5	00M046	Dust	595	mg/kg	KELLOGG
2000090300 - 6	00M047	Dust	696	mg/kg	KELLOGG
2000090300 - 8	00M049	Dust	475	mg/kg	KELLOGG
2000090300 - 9	00M050	Dust	941	mg/kg	KELLOGG
2000090300 - 11	00M052	Dust	892	mg/kg	KELLOGG
2000090300 - 15	00M056	Dust	3760	mg/kg	KELLOGG
2000090300 - 16	00M057	Dust	1380	mg/kg	KELLOGG
2000090300 - 17	00M058	Dust	1170	mg/kg	KELLOGG
2000090300 - 18	00M059	Dust	564	mg/kg	KELLOGG
2000090300 - 19	00M060	Dust	606	mg/kg	KELLOGG
2000090300 - 20	00M061	Dust	867	mg/kg	KELLOGG
2000090301 - 1	00M062	Dust	2440	mg/kg	KELLOGG
2000090301 - 2	00M063	Dust	518	mg/kg	KELLOGG
2000090301 - 4	00M065	Dust	1760	mg/kg	KELLOGG
2000090301 - 5	00M066	Dust	1180	mg/kg	KELLOGG
2000090301 - 6	00M067	Dust	680	mg/kg	KELLOGG
2000090301 - 10	00M071	Dust	1080	mg/kg	KELLOGG
2000090301 - 11	00M072	Dust	246	mg/kg	KELLOGG
2000090301 - 12	00M073	Dust	1270	mg/kg	KELLOGG
2000090301 - 13	00M074	Dust	2100	mg/kg	KELLOGG
2000090301 - 14	00M075	Dust	278	mg/kg	KELLOGG
2000090301 - 15	00M076	Dust	2450	mg/kg	KELLOGG
2000090301 - 16	00M077	Dust	1170	mg/kg	KELLOGG
2000090301 - 17	00M078	Dust	2770	mg/kg	KELLOGG
2000090301 - 18	00M079	Dust	478	mg/kg	KELLOGG
2000090302 - 15	00M096	Dust	657	mg/kg	KELLOGG
2000090302 - 17	00M098	Dust	373	mg/kg	KELLOGG
2000090302 - 18	00M099	Dust	1960	mg/kg	KELLOGG
2000090302 - 19	00M100	Dust	544	mg/kg	KELLOGG
2000090302 - 20	00M101	Dust	1340	mg/kg	KELLOGG
2000090303 - 1	00M102	Dust	1100	mg/kg	KELLOGG
2000090303 - 2	00M103	Dust	406	mg/kg	KELLOGG

* Amount of sample was insufficient for laboratory analysis.

Table 1 (cont'd) Panhandle Health District and TerraGraphics' Combined Dust Mat Data

Lab ID	Sample ID	Type	Lead Concentration	Units	Location
2000090303 - 4	00M105	Dust	2990	mg/kg	KELLOGG
2000090303 - 6	00M107	Dust	502	mg/kg	KELLOGG
2000090303 - 7	00M108	Dust	449	mg/kg	KELLOGG
2000090303 - 8	00M109	Dust	1570	mg/kg	KELLOGG
2000090303 - 9	00M110	Dust	628	mg/kg	KELLOGG
2000090303 - 10	00M111	Dust	2690	mg/kg	KELLOGG
2000090303 - 11	00M112	Dust	798	mg/kg	KELLOGG
2000090303 - 17	00M118	Dust	1140	mg/kg	KELLOGG
2000090303 - 18	00M119	Dust	410	mg/kg	KELLOGG
2000090303 - 19	00M120	Dust	406	mg/kg	KELLOGG
2000090303 - 20	00M121	Dust	876	mg/kg	KELLOGG
2000090304 - 2	00M123	Dust	1860	mg/kg	KELLOGG
2000090304 - 3	00M124	Dust	489	mg/kg	KELLOGG
2000090304 - 8	00M129	Dust	416	mg/kg	KELLOGG
2000090304 - 9	00M130	Dust	1540	mg/kg	KELLOGG
2000090304 - 10	00M131	Dust	278	mg/kg	KELLOGG
2000090304 - 12	00M133	Dust	500	mg/kg	KELLOGG
2000090304 - 13	00M134	Dust	1970	mg/kg	KELLOGG
2000090304 - 14	00M135	Dust	1160	mg/kg	KELLOGG
2000090304 - 15	00M136	Dust	1810	mg/kg	KELLOGG
2000090304 - 16	00M137	Dust	2890	mg/kg	KELLOGG
2000090304 - 17	00M138	Dust	4880	mg/kg	KELLOGG
2000090305 - 5	00M146	Dust	317	mg/kg	KELLOGG
2000090305 - 6	00M148	Dust	395	mg/kg	KELLOGG
2000090305 - 7	00M149	Dust	665	mg/kg	KELLOGG
2000090305 - 8	00M150	Dust	174	mg/kg	KELLOGG
2000090305 - 9	00M151	Dust	insufficient volume*		KELLOGG
2000090305 - 10	00M152	Dust	insufficient volume*		KELLOGG
2000090305 - 11	00M153	Dust	1130	mg/kg	KELLOGG
2000090305 - 12	00M154	Dust	insufficient volume*		KELLOGG
2000090305 - 19	00M161	Dust	300	mg/kg	KELLOGG
2000090305 - 20	00M162	Dust	684	mg/kg	KELLOGG
2000100049 - 1	00M163	Dust	464	mg/kg	KELLOGG
2000100049 - 7	00M169	Dust	1590	mg/kg	KELLOGG
2000100049 - 8	00M170	Dust	934	mg/kg	KELLOGG
2000100049 - 9	00M171	Dust	3120	mg/kg	KELLOGG
2000100049 - 10	00M172	Dust	623	mg/kg	KELLOGG
2000100049 - 11	00M173	Dust	560	mg/kg	KELLOGG
2000100049 - 13	00M175	Dust	2250	mg/kg	KELLOGG
2000100049 - 14	00M176	Dust	1080	mg/kg	KELLOGG
2000100049 - 15	00M177	Dust	2030	mg/kg	KELLOGG
2000100049 - 17	00M179	Dust	417	mg/kg	KELLOGG
2000100049 - 18	00M180	Dust	832	mg/kg	KELLOGG
2000100050 - 5	00M187	Dust	789	mg/kg	KELLOGG
2000100050 - 6	00M188	Dust	1080	mg/kg	KELLOGG

* Amount of sample was insufficient for laboratory analysis.

Table 1 (cont'd) Panhandle Health District and TerraGraphics' Combined Dust Mat Data

Lab ID	Sample ID	Type	Lead Concentration	Units	Location
2000100050 - 7	00M189	Dust	1270	mg/kg	KELLOGG
2000100050 - 9	00M191	Dust	1090	mg/kg	KELLOGG
2000100050 - 10	00M192	Dust	insufficient volume*		KELLOGG
2000100050 - 11	00M193	Dust	658	mg/kg	KELLOGG
2000100050 - 12	00M194	Dust	925	mg/kg	KELLOGG
2000100050 - 13	00M195	Dust	insufficient volume*		KELLOGG
2000100051 - 5	00M207	Dust	4600	mg/kg	KELLOGG
2000100051 - 6	00M208	Dust	1770	mg/kg	KELLOGG
2000100051 - 7	00M209	Dust	623	mg/kg	KELLOGG
2000100051 - 15	00M217	Dust	593	mg/kg	KELLOGG
2000100051 - 17	00M219	Dust	727	mg/kg	KELLOGG
2000100052 - 1	00M223	Dust	443	mg/kg	KELLOGG
2000100052 - 2	00M224	Dust	200	mg/kg	KELLOGG
2000100052 - 14	00M236	Dust	3560	mg/kg	KELLOGG
2000100052 - 15	00M237	Dust	1350	mg/kg	KELLOGG
2000100052 - 16	00M238	Dust	insufficient volume*		KELLOGG
2000100052 - 17	00M239	Dust	insufficient volume*		KELLOGG
2000100053 - 5	00M247	Dust	1260	mg/kg	KELLOGG
2000100053 - 7	00M249	Dust	insufficient volume*		KELLOGG
2000100053 - 8	00M250	Dust	1260	mg/kg	KELLOGG
2000100053 - 10	00M252	Dust	13000	mg/kg	KELLOGG
2000100053 - 11	00M253	Dust	1120	mg/kg	KELLOGG
2000100053 - 12	00M254	Dust	insufficient volume*		KELLOGG
2000100053 - 13	00M255	Dust	658	mg/kg	KELLOGG
2000100053 - 14	00M256	Dust	742	mg/kg	KELLOGG
2000100053 - 15	00M257	Dust	1020	mg/kg	KELLOGG
2000100053 - 16	00M258	Dust	490	mg/kg	KELLOGG
2000100053 - 17	00M259	Dust	550	mg/kg	KELLOGG
2000100053 - 18	00M260	Dust	620	mg/kg	KELLOGG
2000100207 - 2	00M264	Dust	757	mg/kg	KELLOGG
2000100207 - 3	00M265	Dust	455	mg/kg	KELLOGG
2000100207 - 5	00M267	Dust	1900	mg/kg	KELLOGG
2000100207 - 6	00M268	Dust	831	mg/kg	KELLOGG
2000100207 - 7	00M269	Dust	1040	mg/kg	KELLOGG
2000100207 - 8	00M270	Dust	1080	mg/kg	KELLOGG
2000100208 - 20	00M271	Dust	3240	mg/kg	KELLOGG
2000100210 - 20	00M272	Dust	605	mg/kg	KELLOGG
2000100207 - 9	00M273	Dust	673	mg/kg	KELLOGG
2000100207 - 10	00M274	Dust	850	mg/kg	KELLOGG
2000100207 - 11	00M275	Dust	insufficient volume*		KELLOGG
2000100207 - 12	00M276	Dust	4350	mg/kg	KELLOGG
2000100207 - 13	00M277	Dust	354	mg/kg	KELLOGG
2000100208 - 1	00M284	Dust	insufficient volume*		KELLOGG
2000100208 - 3	00M286	Dust	3370	mg/kg	KELLOGG
2000100208 - 4	00M287	Dust	820	mg/kg	KELLOGG
2000100208 - 5	00M288	Dust	780	mg/kg	KELLOGG

* Amount of sample was insufficient for laboratory analysis.

Table 1 (cont'd) Panhandle Health District and TerraGraphics' Combined Dust Mat Data

Lab ID	Sample ID	Type	Lead Concentration	Units	Location
2000100208 - 7	00M290	Dust	350	mg/kg	KELLOGG
2000100209 - 3	00M305	Dust	667	mg/kg	KELLOGG
2000100209 - 4	00M306	Dust	420	mg/kg	KELLOGG
2000100209 - 5	00M307	Dust	691	mg/kg	KELLOGG
2000100209 - 6	00M308	Dust	857	mg/kg	KELLOGG
2000100209 - 7	00M309	Dust	894	mg/kg	KELLOGG
2000100209 - 8	00M310	Dust	368	mg/kg	KELLOGG
2000100209 - 9	00M311	Dust	462	mg/kg	KELLOGG
2000100209 - 10	00M312	Dust	274	mg/kg	KELLOGG
2000100209 - 12	00M314	Dust	1340	mg/kg	KELLOGG
2000100209 - 13	00M315	Dust	insufficient volume*		KELLOGG
2000100209 - 14	00M316	Dust	311	mg/kg	KELLOGG
2000100209 - 15	00M317	Dust	1520	mg/kg	KELLOGG
2000100209 - 16	00M318	Dust	884	mg/kg	KELLOGG
2000100209 - 17	00M319	Dust	1050	mg/kg	KELLOGG
2000100209 - 18	00M320	Dust	1810	mg/kg	KELLOGG
2000100209 - 19	00M321	Dust	882	mg/kg	KELLOGG
2000100209 - 20	00M322	Dust	insufficient volume*		KELLOGG
2000100210 - 1	00M323	Dust	insufficient volume*		KELLOGG
2000100210 - 2	00M324	Dust	674	mg/kg	KELLOGG
2000100210 - 3	00M325	Dust	1240	mg/kg	KELLOGG
2000100210 - 4	00M326	Dust	1230	mg/kg	KELLOGG
2000100210 - 5	00M327	Dust	694	mg/kg	KELLOGG
2000100210 - 6	00M328	Dust	3800	mg/kg	KELLOGG
2000100210 - 7	00M329	Dust	1090	mg/kg	KELLOGG
2000100210 - 8	00M330	Dust	603	mg/kg	KELLOGG
2000100210 - 10	00M332	Dust	4140	mg/kg	KELLOGG
2000100210 - 11	00M333	Dust	insufficient volume*		KELLOGG
2000100210 - 12	00M334	Dust	440	mg/kg	KELLOGG
2000100210 - 13	00M335	Dust	360	mg/kg	KELLOGG
2000100210 - 14	00M336	Dust	insufficient volume*		KELLOGG
2000100210 - 15	00M337	Dust	1230	mg/kg	KELLOGG
2000100210 - 16	00M338	Dust	484	mg/kg	KELLOGG
2000100210 - 17	00M339	Dust	1920	mg/kg	KELLOGG
2000100210 - 18	00M340	Dust	652	mg/kg	KELLOGG
2000100207 - 20	00M341	Dust	807	mg/kg	KELLOGG
2000100211 - 1	00M343	Dust	1520	mg/kg	KELLOGG
2000100211 - 2	00M344	Dust	3290	mg/kg	KELLOGG
2000100211 - 3	00M345	Dust	860	mg/kg	KELLOGG
2000100211 - 4	00M346	Dust	1910	mg/kg	KELLOGG
2000100211 - 6	00M348	Dust	490	mg/kg	KELLOGG
2000100211 - 9	00M351	Dust	825	mg/kg	KELLOGG
2000100211 - 10	00M352	Dust	820	mg/kg	KELLOGG
2000100211 - 11	00M353	Dust	2090	mg/kg	KELLOGG
2000100211 - 12	00M354	Dust	409	mg/kg	KELLOGG
2000100211 - 13	00M355	Dust	1140	mg/kg	KELLOGG

* Amount of sample was insufficient for laboratory analysis.

Table 1 (cont'd) Panhandle Health District and TerraGraphics' Combined Dust Mat Data

Lab ID	Sample ID	Type	Lead Concentration	Units	Location
2000100211 - 14	00M356	Dust	848	mg/kg	KELLOGG
2000100211 - 15	00M357	Dust	2290	mg/kg	KELLOGG
2000100211 - 16	00M358	Dust	481	mg/kg	KELLOGG
2000100211 - 17	00M359	Dust	349	mg/kg	KELLOGG
2000100213 - 2	00M384	Dust	1760	mg/kg	KELLOGG
2000100213 - 3	00M385	Dust	1320	mg/kg	KELLOGG
2000100213 - 4	00M386	Dust	830	mg/kg	KELLOGG
2000100213 - 6	00M388	Dust	insufficient volume*		KELLOGG
2000100217 - 1	00M423	Dust	insufficient volume*		KELLOGG
2000100217 - 2	00M424	Dust	insufficient volume*		KELLOGG
2000100217 - 16	00M438	Dust	593	mg/kg	KELLOGG
2000100217 - 17	00M439	Dust	insufficient volume*		KELLOGG
2000100218 - 2	00M444	Dust	805	mg/kg	KELLOGG
2000100218 - 3	00M445	Dust	2100	mg/kg	KELLOGG
2000100218 - 4	00M446	Dust	insufficient volume*		KELLOGG
2000100218 - 6	00M448	Dust	15500	mg/kg	KELLOGG
2000100218 - 7	00M449	Dust	958	mg/kg	KELLOGG
2000090303 - 13	00M114	Dust	220	mg/kg	PAGE
2000090303 - 14	00M115	Dust	275	mg/kg	PAGE
2000090303 - 15	00M116	Dust	448	mg/kg	PAGE
2000100050 - 14	00M196	Dust	393	mg/kg	PAGE
2000100217 - 12	00M434	Dust	760	mg/kg	PAGE
2000100217 - 13	00M435	Dust	180	mg/kg	PAGE
2000100217 - 14	00M436	Dust	585	mg/kg	PAGE
2000100217 - 15	00M437	Dust	1400	mg/kg	PAGE
2000090299 - 12	00M033	Dust	426	mg/kg	PINEHURST
2000090299 - 13	00M034	Dust	615	mg/kg	PINEHURST
2000090299 - 14	00M035	Dust	348	mg/kg	PINEHURST
2000090299 - 15	00M036	Dust	404	mg/kg	PINEHURST
2000090299 - 16	00M037	Dust	236	mg/kg	PINEHURST
2000090299 - 17	00M038	Dust	476	mg/kg	PINEHURST
2000090300 - 10	00M051	Dust	406	mg/kg	PINEHURST
2000090300 - 12	00M053	Dust	159	mg/kg	PINEHURST
2000090300 - 13	00M054	Dust	153	mg/kg	PINEHURST
2000090300 - 14	00M055	Dust	182	mg/kg	PINEHURST
2000090301 - 7	00M068	Dust	416	mg/kg	PINEHURST
2000090301 - 8	00M069	Dust	570	mg/kg	PINEHURST
2000090302 - 1	00M082	Dust	230	mg/kg	PINEHURST
2000090302 - 3	00M084	Dust	461	mg/kg	PINEHURST
2000090302 - 4	00M085	Dust	360	mg/kg	PINEHURST
2000090302 - 5	00M086	Dust	395	mg/kg	PINEHURST
2000090302 - 6	00M087	Dust	281	mg/kg	PINEHURST
2000090302 - 8	00M089	Dust	485	mg/kg	PINEHURST
2000090302 - 9	00M090	Dust	474	mg/kg	PINEHURST
2000090302 - 10	00M091	Dust	508	mg/kg	PINEHURST
2000090302 - 11	00M092	Dust	1040	mg/kg	PINEHURST

* Amount of sample was insufficient for laboratory analysis.

Table 1 (cont'd) Panhandle Health District and TerraGraphics' Combined Dust Mat Data

Lab ID	Sample ID	Type	Lead Concentration	Units	Location
2000090302 - 12	00M093	Dust	292	mg/kg	PINEHURST
2000090302 - 13	00M094	Dust	112	mg/kg	PINEHURST
2000090302 - 14	00M095	Dust	70	mg/kg	PINEHURST
2000090304 - 5	00M126	Dust	400	mg/kg	PINEHURST
2000090304 - 6	00M127	Dust	331	mg/kg	PINEHURST
2000090304 - 18	00M139	Dust	494	mg/kg	PINEHURST
2000090304 - 19	00M140	Dust	298	mg/kg	PINEHURST
2000090304 - 20	00M141	Dust	280	mg/kg	PINEHURST
2000090305 - 1	00M142	Dust	465	mg/kg	PINEHURST
2000090305 - 4	00M145	Dust	1840	mg/kg	PINEHURST
2000100049 - 4	00M166	Dust	insufficient volume*		PINEHURST
2000100049 - 5	00M167	Dust	481	mg/kg	PINEHURST
2000100049 - 6	00M168	Dust	291	mg/kg	PINEHURST
2000100049 - 19	00M181	Dust	558	mg/kg	PINEHURST
2000100049 - 20	00M182	Dust	203	mg/kg	PINEHURST
2000100050 - 1	00M183	Dust	300	mg/kg	PINEHURST
2000100050 - 2	00M184	Dust	236	mg/kg	PINEHURST
2000100050 - 3	00M185	Dust	180	mg/kg	PINEHURST
2000100050 - 4	00M186	Dust	438	mg/kg	PINEHURST
2000100050 - 15	00M197	Dust	702	mg/kg	PINEHURST
2000100050 - 16	00M198	Dust	1220	mg/kg	PINEHURST
2000100050 - 18	00M200	Dust	2150	mg/kg	PINEHURST
2000100050 - 19	00M201	Dust	520	mg/kg	PINEHURST
2000100050 - 20	00M202	Dust	7830	mg/kg	PINEHURST
2000100051 - 1	00M203	Dust	429	mg/kg	PINEHURST
2000100051 - 2	00M204	Dust	351	mg/kg	PINEHURST
2000100051 - 3	00M205	Dust	398	mg/kg	PINEHURST
2000100053 - 9	00M251	Dust	306	mg/kg	PINEHURST
2000100208 - 15	00M298	Dust	1070	mg/kg	PINEHURST
2000100208 - 16	00M299	Dust	370	mg/kg	PINEHURST
2000100208 - 17	00M300	Dust	603	mg/kg	PINEHURST
2000100208 - 18	00M301	Dust	240	mg/kg	PINEHURST
2000100208 - 19	00M302	Dust	insufficient volume*		PINEHURST
2000100211 - 18	00M360	Dust	453	mg/kg	PINEHURST
2000100211 - 19	00M361	Dust	insufficient volume*		PINEHURST
2000100211 - 20	00M362	Dust	1020	mg/kg	PINEHURST
2000100212 - 1	00M363	Dust	646	mg/kg	PINEHURST
2000100212 - 2	00M364	Dust	488	mg/kg	PINEHURST
2000100212 - 3	00M365	Dust	442	mg/kg	PINEHURST
2000100212 - 4	00M366	Dust	398	mg/kg	PINEHURST
2000100212 - 5	00M367	Dust	1190	mg/kg	PINEHURST
2000100212 - 8	00M370	Dust	2060	mg/kg	PINEHURST
2000100212 - 9	00M371	Dust	386	mg/kg	PINEHURST
2000100212 - 10	00M372	Dust	757	mg/kg	PINEHURST
2000100212 - 12	00M374	Dust	316	mg/kg	PINEHURST

* Amount of sample was insufficient for laboratory analysis.

Table 1 (cont'd) Panhandle Health District and TerraGraphics' Combined Dust Mat Data

Lab ID	Sample ID	Type	Lead Concentration	Units	Location
2000100212 - 13	00M375	Dust	586	mg/kg	PINEHURST
2000100212 - 20	00M382	Dust	470	mg/kg	PINEHURST
2000100213 - 7	00M389	Dust	307	mg/kg	PINEHURST
2000100217 - 18	00M440	Dust	insufficient volume*		PINEHURST
2000100218 - 1	00M443	Dust	255	mg/kg	PINEHURST
2000090301 - 19	00M080	Dust	728	mg/kg	SMELTERVILLE
2000090301 - 20	00M081	Dust	486	mg/kg	SMELTERVILLE
2000090302 - 16	00M097	Dust	592	mg/kg	SMELTERVILLE
2000090303 - 12	00M113	Dust	400	mg/kg	SMELTERVILLE
2000090303 - 16	00M117	Dust	786	mg/kg	SMELTERVILLE
2000090304 - 11	00M132	Dust	694	mg/kg	SMELTERVILLE
2000090305 - 3	00M144	Dust	351	mg/kg	SMELTERVILLE
2000090305 - 13	00M155	Dust	540	mg/kg	SMELTERVILLE
2000090305 - 15	00M157	Dust	264	mg/kg	SMELTERVILLE
2000090305 - 16	00M158	Dust	404	mg/kg	SMELTERVILLE
2000090305 - 17	00M159	Dust	331	mg/kg	SMELTERVILLE
2000090305 - 18	00M160	Dust	162	mg/kg	SMELTERVILLE
2000100049 - 2	00M164	Dust	241	mg/kg	SMELTERVILLE
2000100049 - 16	00M178	Dust	697	mg/kg	SMELTERVILLE
2000100053 - 4	00M246	Dust	insufficient volume*		SMELTERVILLE
2000100207 - 14	00M278	Dust	851	mg/kg	SMELTERVILLE
2000100207 - 15	00M279	Dust	546	mg/kg	SMELTERVILLE
2000100207 - 16	00M280	Dust	973	mg/kg	SMELTERVILLE
2000100207 - 17	00M281	Dust	insufficient volume*		SMELTERVILLE
2000100207 - 18	00M282	Dust	260	mg/kg	SMELTERVILLE
2000100207 - 19	00M283	Dust	629	mg/kg	SMELTERVILLE
2000100208 - 9	00M292	Dust	945	mg/kg	SMELTERVILLE
2000100208 - 10	00M293	Dust	642	mg/kg	SMELTERVILLE
2000100208 - 11	00M294	Dust	220	mg/kg	SMELTERVILLE
2000100208 - 12	00M295	Dust	692	mg/kg	SMELTERVILLE
2000100208 - 13	00M296	Dust	2600	mg/kg	SMELTERVILLE
2000100208 - 14	00M297	Dust	190	mg/kg	SMELTERVILLE
2000100209 - 1	00M303	Dust	1540	mg/kg	SMELTERVILLE
2000100212 - 14	00M376	Dust	1400	mg/kg	SMELTERVILLE
2000100212 - 15	00M377	Dust	675	mg/kg	SMELTERVILLE
2000100212 - 16	00M378	Dust	357	mg/kg	SMELTERVILLE
2000100212 - 17	00M379	Dust	insufficient volume*		SMELTERVILLE
2000100212 - 18	00M380	Dust	593	mg/kg	SMELTERVILLE
2000100212 - 19	00M381	Dust	858	mg/kg	SMELTERVILLE
2000100213 - 8	00M390	Dust	2640	mg/kg	SMELTERVILLE
2000100213 - 9	00M391	Dust	insufficient volume*		SMELTERVILLE
2000100213 - 10	00M392	Dust	720	mg/kg	SMELTERVILLE
2000100213 - 11	00M393	Dust	insufficient volume*		SMELTERVILLE
2000100213 - 12	00M394	Dust	386	mg/kg	SMELTERVILLE
2000100213 - 13	00M395	Dust	400	mg/kg	SMELTERVILLE
2000100213 - 20	00M402	Dust	4110	mg/kg	SMELTERVILLE

* Amount of sample was insufficient for laboratory analysis.

Table 1 (cont'd) Panhandle Health District and TerraGraphics' Combined Dust Mat Data

Lab ID	Sample ID	Type	Lead Concentration	Units	Location
2000100216 - 1	00M403	Dust	669	mg/kg	SMELTERVILLE
2000100216 - 2	00M404	Dust	424	mg/kg	SMELTERVILLE
2000100216 - 5	00M407	Dust	899	mg/kg	SMELTERVILLE
2000100216 - 6	00M408	Dust	1560	mg/kg	SMELTERVILLE
2000100216 - 7	00M409	Dust	378	mg/kg	SMELTERVILLE
2000100216 - 8	00M410	Dust	436	mg/kg	SMELTERVILLE
2000100216 - 10	00M412	Dust	1690	mg/kg	SMELTERVILLE
2000100216 - 11	00M413	Dust	insufficient volume*		SMELTERVILLE
2000100216 - 13	00M415	Dust	487	mg/kg	SMELTERVILLE
2000100216 - 14	00M416	Dust	290	mg/kg	SMELTERVILLE
2000100216 - 15	00M417	Dust	355	mg/kg	SMELTERVILLE
2000100216 - 16	00M418	Dust	insufficient volume*		SMELTERVILLE
2000100216 - 17	00M419	Dust	190	mg/kg	SMELTERVILLE
2000100216 - 18	00M420	Dust	337	mg/kg	SMELTERVILLE
2000100216 - 19	00M421	Dust	198	mg/kg	SMELTERVILLE
2000100216 - 20	00M422	Dust	702	mg/kg	SMELTERVILLE
2000100217 - 4	00M426	Dust	insufficient volume*		SMELTERVILLE
2000100217 - 5	00M427	Dust	382	mg/kg	SMELTERVILLE
2000100217 - 6	00M428	Dust	625	mg/kg	SMELTERVILLE
2000100217 - 19	00M441	Dust	433	mg/kg	SMELTERVILLE
2000100217 - 20	00M442	Dust	461	mg/kg	SMELTERVILLE
2000090299 - 20	00M041	Dust	2130	mg/kg	WARDNER
2000090304 - 1	00M122	Dust	710	mg/kg	WARDNER
2000100051 - 4	00M206	Dust	684	mg/kg	WARDNER
2000100213 - 14	00M396	Dust	634	mg/kg	WARDNER
2000100213 - 15	00M397	Dust	insufficient volume*		WARDNER
2000100213 - 16	00M398	Dust	2780	mg/kg	WARDNER
2000100213 - 17	00M399	Dust	486	mg/kg	WARDNER
2000100213 - 18	00M400	Dust	514	mg/kg	WARDNER
2000100213 - 19	00M401	Dust	insufficient volume*		WARDNER
2000100217 - 9	00M431	Dust	1780	mg/kg	WARDNER
2000100217 - 11	00M433	Dust	620	mg/kg	WARDNER

* Amount of sample was insufficient for laboratory analysis.

Table 2 - Rejected Dust Mat Data

Lab ID	Sample ID	Lead Concentration	Units	Location	Notes
2000090298 - 19	00M020	789	mg/kg	KELLOGG	Rejected due to mis-labeling in the field
2000090298 - 20	00M021	505	mg/kg	KELLOGG	Rejected due to mis-labeling in the field
2000100051 - 9	00M211	2520	mg/kg	KELLOGG	Rejected due to mis-labeling in the laboratory
2000100051 - 10	00M212	4500	mg/kg	KELLOGG	Rejected due to mis-labeling in the laboratory
2000100051 - 12	00M214	4200	mg/kg	KELLOGG	Rejected due to mis-labeling in the laboratory
2000100051 - 13	00M215	1670	mg/kg	KELLOGG	Rejected due to mis-labeling in the laboratory
2000100051 - 14	00M216	455	mg/kg	KELLOGG	Rejected due to mis-labeling in the laboratory
2000100051 - 16	00M218	800	mg/kg	KELLOGG	Rejected due to mis-labeling in the laboratory
2000090298 - 13	00M014	742	mg/kg	PINEHURST	Rejected due to mis-labeling in the field
2000090298 - 15	00M016	361	mg/kg	PINEHURST	Rejected due to mis-labeling in the field
2000090298 - 16	00M017	437	mg/kg	PINEHURST	Rejected due to mis-labeling in the field
2000090298 - 17	00M018	280	mg/kg	PINEHURST	Rejected due to mis-labeling in the field
2000090298 - 18	00M019	457	mg/kg	PINEHURST	Rejected due to mis-labeling in the field
2000100051 - 18	00M220	insufficient volume*		PINEHURST	Rejected due to mis-labeling in the laboratory
2000100051 - 19	00M221	851	mg/kg	PINEHURST	Rejected due to mis-labeling in the laboratory
2000100051 - 20	00M222	1060	mg/kg	PINEHURST	Rejected due to mis-labeling in the laboratory
2000090298 - 1	00M001	239	mg/kg	SMELTERVILLE	Rejected due to mis-labeling in the field
2000090298 - 2	00M002	613	mg/kg	SMELTERVILLE	Rejected due to mis-labeling in the field
2000090298 - 3	00M003	679	mg/kg	SMELTERVILLE	Rejected due to mis-labeling in the field
2000090298 - 4	00M004	860	mg/kg	SMELTERVILLE	Rejected due to mis-labeling in the field
2000090298 - 5	00M005	481	mg/kg	SMELTERVILLE	Rejected due to mis-labeling in the field
2000090298 - 6	00M006	2440	mg/kg	SMELTERVILLE	Rejected due to mis-labeling in the field
2000090298 - 9	00M009	488	mg/kg	SMELTERVILLE	Rejected due to mis-labeling in the field
2000090298 - 10	00M010	insufficient volume*		SMELTERVILLE	Rejected due to mis-labeling in the field
2000090298 - 11	00M011	319	mg/kg	SMELTERVILLE	Rejected due to mis-labeling in the field
2000090298 - 7	00M007	690	mg/kg	WARDNER	Rejected due to mis-labeling in the field
2000090298 - 8	00M008	560	mg/kg	WARDNER	Rejected due to mis-labeling in the field
2000090298 - 14	00M015	471	mg/kg	Duplicate	Rejected due to mis-labeling in the field
2000090298 - 12	00M013	181	mg/kg	Standard	Rejected due to mis-labeling in the field
2000100051 - 11	00M213	4010	mg/kg	Standard	Rejected due to mis-labeling in the laboratory
2000090299 - 10	00M031	641	mg/kg	Standard	Undetermined amount of standard applied to mat

Table 3 - Field Duplicates

Original Lab ID	Duplicate Lab ID	Original Sample ID	Duplicate Sample ID	Original Lead Conc.	Duplicate Lead Conc.	RPD
2000100218 - 4	2000100218 - 5	00M446	00M447	insufficient volume*	570	NA
2000100216 - 11	2000100216 - 12	00M413	00M414	insufficient volume*	insufficient volume*	NA
2000100216 - 8	2000100216 - 9	00M410	00M411	436	470	7.5
2000100212 - 12	2000100212 - 11	00M374	00M373	316	260	19.4
2000100213 - 2	2000100213 - 1	00M384	00M383	1760	insufficient volume*	NA
2000100210 - 20	2000100210 - 19	00M272	00M342	605	633	4.5
2000100211 - 4	2000100211 - 5	00M346	00M347	1910	2140	11.4
2000100208 - 20	2000100208 - 2	00M271	00M285	3240	3120	3.8
2000100207 - 2	2000100207 - 1	00M264	00M263	757	637	17.2
2000100051 - 7	2000100051 - 8	00M209	00M210	623	626	0.5
2000100050 - 7	2000100050 - 8	00M189	00M190	1270	insufficient volume*	NA
2000090304 - 6	2000090304 - 7	00M127	00M128	331	200	49.3
2000090305 - 3	2000090305 - 2	00M144	00M143	351	454	25.6
2000090303 - 6	2000090303 - 5	00M107	00M106	502	458	9.2
2000090302 - 6	2000090302 - 7	00M087	00M088	281	150	60.8
2000090301 - 8	2000090301 - 9	00M069	00M070	570	613	7.3
2000090300 - 6	2000090300 - 7	00M047	00M048	696	718	3.1
2000090299 - 1	2000090299 - 2	00M022	00M023	407	426	4.6
2000100049 - 2	2000100049 - 3	00M164	00M165	241	407	51.2
					Average	18.4

RPD = ABS(X1-X2)/((X1+X2)/2)

X1 = ORIGINAL SAMPLE

X2 = DUPLICATE SAMPLE

* Amount of sample was insufficient for laboratory analysis.

Table 4 - Rinsate Blanks

Lab ID	Sample ID	Lead Concentration	Units
2000100208 - 8	00M291	<0.003	mg/l
2000100209 - 11	00M313	<0.003	mg/l
2000100211 - 8	00M350	<0.003	mg/l
2000100212 - 7	00M369	0.003	mg/l
2000100216 - 4	00M406	<0.003	mg/l
2000100217 - 3	00M425	<0.003	mg/l

<:Concentration below instument detection limit.

Table 5a - Standards (by mass)

Lab ID	Sample ID	Amount Loaded (g)	Amount Recovered (g)	Percent Recovery
2000100217 - 10	00M432	10	7.80	78%
2000100213 - 5	00M387	10	8.03	80%
2000100216 - 3	00M405	10	8.46	85%
2000100212 - 6	00M368	10	8.25	83%
2000100211 - 7	00M349	10	8.39	84%
2000100210 - 9	00M331	10	8.19	82%
2000100209 - 2	00M304	10	8.23	82%
2000090301 - 3	00M064	10	9.12	91%
2000090302 - 2	00M083	10	8.63	86%
2000090303 - 3	00M104	10	8.66	87%
2000090304 - 4	00M125	10	8.43	84%
2000090305 - 14	00M156	10	8.44	84%
2000100049 - 12	00M174	10	8.39	84%
2000100050 - 17	00M199	10	8.08	81%
2000100052 - 8	00M230	10	8.40	84%
2000100053 - 6	00M248	10	8.17	82%
2000100207 - 4	00M266	10	8.32	83%
2000100208 - 6	00M289	10	7.75	78%
2000090300 - 1	00M042	10	8.96	90%
			Average % Recovery	84%

Table 5b - Standards (by concentration)

Lab ID	Sample ID	Amount Loaded (g)	Measured Lead Value (mg/kg)	True Lead Value (mg/kg)	Percent Recovery
2000100217 - 10	00M432	10	766	1162	66%
2000100213 - 5	00M387	10	724	1162	62%
2000100216 - 3	00M405	10	808	1162	70%
2000100212 - 6	00M368	10	751	1162	65%
2000100211 - 7	00M349	10	794	1162	68%
2000100210 - 9	00M331	10	811	1162	70%
2000100209 - 2	00M304	10	815	1162	70%
2000090301 - 3	00M064	10	811	1162	70%
2000090302 - 2	00M083	10	725	1162	62%
2000090303 - 3	00M104	10	733	1162	63%
2000090304 - 4	00M125	10	761	1162	65%
2000090305 - 14	00M156	10	741	1162	64%
2000100049 - 12	00M174	10	749	1162	64%
2000100050 - 17	00M199	10	774	1162	67%
2000100052 - 8	00M230	10	786	1162	68%
2000100053 - 6	00M248	10	738	1162	64%
2000100207 - 4	00M266	10	718	1162	62%
2000100208 - 6	00M289	10	714	1162	61%
2000090300 - 1	00M042	10	781	1162	67%
				Average % Recovery	66%

Table 5c - Percent Recovery Results

Lab ID	Sample ID	Pre-loading Sample Weight (g)	Sample Conc. (ug/g)	Amount Lead Applied to mat (ug)	Recovered Sample Weight (g)	Recovered Sample Conc. (ug/g)	Amount Lead in Sample (ug)	Percent Recovery Dust (mass)	Percent Recovery Lead (conc.)	Percent Recovery Lead (mass)
2000100217 - 10	00M432	10	1162	11620	7.80	766	5975	78%	66%	51%
2000100213 - 5	00M387	10	1162	11620	8.03	724	5814	80%	62%	50%
2000100216 - 3	00M405	10	1162	11620	8.46	808	6836	85%	70%	59%
2000100212 - 6	00M368	10	1162	11620	8.25	751	6196	83%	65%	53%
2000100211 - 7	00M349	10	1162	11620	8.39	794	6662	84%	68%	57%
2000100210 - 9	00M331	10	1162	11620	8.19	811	6642	82%	70%	57%
2000100209 - 2	00M304	10	1162	11620	8.23	815	6707	82%	70%	58%
2000090301 - 3	00M064	10	1162	11620	9.12	811	7396	91%	70%	64%
2000090302 - 2	00M083	10	1162	11620	8.63	725	6257	86%	62%	54%
2000090303 - 3	00M104	10	1162	11620	8.66	733	6348	87%	63%	55%
2000090304 - 4	00M125	10	1162	11620	8.43	761	6415	84%	65%	55%
2000090305 - 14	00M156	10	1162	11620	8.44	741	6254	84%	64%	54%
2000100049 - 12	00M174	10	1162	11620	8.39	749	6284	84%	64%	54%
2000100050 - 17	00M199	10	1162	11620	8.08	774	6254	81%	67%	54%
2000100052 - 8	00M230	10	1162	11620	8.40	786	6602	84%	68%	57%
2000100053 - 6	00M248	10	1162	11620	8.17	738	6029	82%	64%	52%
2000100207 - 4	00M266	10	1162	11620	8.32	718	5974	83%	62%	51%
2000100208 - 6	00M289	10	1162	11620	7.75	714	5534	78%	61%	48%
2000090300 - 1	00M042	10	1162	11620	8.96	781	6998	90%	67%	60%
							Average	84%	66%	55%

Table 6 - Laboratory Prep Blanks

Lab ID	Lead Concentration	units
2000090298 - 21	<0.05	mg/l
2000090299 - 21	<0.05	mg/l
2000090300 - 21	<0.05	mg/l
2000090301 - 21	<0.05	mg/l
2000090302 - 21	<0.05	mg/l
2000090303 - 21	<0.05	mg/l
2000090304 - 21	<0.05	mg/l
2000090305 - 21	<0.05	mg/l
2000100049 - 21	<0.05	mg/l
2000100050 - 21	<0.05	mg/l
2000100051 - 21	<0.05	mg/l
2000100052 - 21	<0.05	mg/l
2000100053 - 19	<0.05	mg/l
2000100207 - 21	<0.05	mg/l
2000100208 - 21	<0.05	mg/l
2000100209 - 21	<0.05	mg/l
2000100210 - 21	<0.05	mg/l
2000100211 - 21	<0.05	mg/l
2000100212 - 21	<0.05	mg/l
2000100213 - 21	<0.05	mg/l
2000100216 - 21	<0.05	mg/l
2000100217 - 21	<0.05	mg/l
2000100218 - 8	<0.05	mg/l

<:Concentration below instument detection limit.

Table 7 - Aqueous LCS

Lab ID	Measured Value (mg/L)	True Value (mg/L)	Percent Recovery	Acceptable % Range
2000090298 - 22	5.29	5.00	106%	80-120%
2000090299 - 22	5.32	5.00	106%	80-120%
2000090300 - 22	5.23	5.00	105%	80-120%
2000090301 - 22	5.4	5.00	108%	80-120%
2000090302 - 22	6.3	6.00	105%	80-120%
2000090303 - 22	5.20	5.00	104%	80-120%
2000090304 - 22	5.15	5.00	103%	80-120%
2000090305 - 22	5.05	5.00	101%	80-120%
2000100049 - 22	4.94	5.00	99%	80-120%
2000100050 - 22	4.97	5.00	99%	80-120%
2000100051 - 22	5.07	5.00	101%	80-120%
2000100052 - 22	4.83	5.00	97%	80-120%
2000100053 - 20	4.75	5.00	95%	80-120%
2000100207 - 22	4.92	5.00	98%	80-120%
2000100208 - 22	5.00	5.00	100%	80-120%
2000100209 - 22	4.90	5.00	98%	80-120%
2000100210 - 22	4.97	5.00	99%	80-120%
2000100211 - 22	5.31	5.00	106%	80-120%
2000100212 - 22	5.19	5.00	104%	80-120%
2000100213 - 22	5.29	5.00	106%	80-120%
2000100216 - 22	4.75	5.00	95%	80-120%
2000100217 - 22	5.18	5.00	104%	80-120%
2000100218 - 9	5.13	5.00	103%	80-120%

Percent Recovery = (Northern Conc.)/(Known Conc.)* 100

Table 8 - Soil LCS

Lab ID	Measured Value (mg/kg)	True Value (mg/kg)	Percent Recovery	Acceptable % Range*
2000090298 - 23	1604	1392	115%	84-116%
2000090299 - 23	85.8	100.3	86%	62-137%
2000090300 - 23	90.0	100.3	90%	62-137%
2000090301 - 23	103	100.3	103%	75-126%
2000090302 - 23	101	100.3	101%	75-126%
2000090303 - 23	100	100	100%	63-138%
2000090304 - 23	83	100	83%	63-138%
2000090305 - 23	452	444	102%	82-114%
2000100049 - 23	768	735	104%	82-118%
2000100050 - 23	768	735	104%	82-118%
2000100051 - 23	774	735	105%	82-118%
2000100052 - 23	768	735	104%	82-118%
2000100053 - 21	746	735	101%	82-118%
2000100207 - 23	1760	1521	116%	83-117%
2000100208 - 23	1410	1521	93%	83-117%
2000100209 - 23	1471	1521	97%	83-117%
2000100210 - 23	1730	1521	114%	83-117%
2000100211 - 23	1720	1521	113%	83-117%
2000100212 - 23	1499	1521	99%	83-117%
2000100213 - 23	1560	1521	103%	83-117%
2000100216 - 23	1526	1521	100%	83-117%
2000100217 - 23	1560	1521	103%	83-117%
2000100218 - 10	1526	1521	100%	83-117%

Percent Recovery = (Northern Conc.)/(Known Conc.) * 100
* as reported by Northern Analytical

Table 9 - Laboratory Matrix Spike/Matrix Spike Duplicates

Lab ID MS	Lab ID MS/D	Units	MS Concentration	MS/D Concentration	RPD
2000090298 - 24	2000090298 - 25	mg/kg	1010	980	3.0
2000090299 - 24	2000090299 - 25	mg/kg	1120	1100	1.8
2000090300 - 24	2000090300 - 25	mg/kg	660	643	2.6
2000090301 - 24	2000090301 - 25	mg/kg	1080	1060	1.9
2000090302 - 24	2000090302 - 25	mg/kg	1430	1450	1.4
2000090303 - 24	2000090303 - 25	mg/kg	2600	2790	7.1
2000090304 - 24	2000090304 - 25	mg/kg	1500	1520	1.3
2000090305 - 24	2000090305 - 25	mg/kg	1630	1580	3.1
2000100049 - 24	2000100049 - 25	mg/kg	1400	1220	13.7
2000100050 - 24	2000100050 - 25	mg/kg	758	728	4.0
2000100051 - 24	2000100051 - 25	mg/kg	821	831	1.2
2000100052 - 24	2000100052 - 25	mg/kg	972	1026	5.4
2000100053 - 22	2000100053 - 23	mg/kg	1660	1660	0.0
2000100207 - 24	2000100207 - 25	mg/kg	1480	1440	2.7
2000100208 - 24	2000100208 - 25	mg/kg	1540	1530	0.7
2000100209 - 24	2000100209 - 25	mg/kg	2080	2060	1.0
2000100210 - 24	2000100210 - 25	mg/kg	1910	1710	11.0
2000100211 - 24	2000100211 - 25	mg/kg	1792	1780	0.7
2000100212 - 24	2000100212 - 25	mg/kg	1190	1180	0.8
2000100213 - 24	2000100213 - 25	mg/kg	4770	4560	4.5
2000100216 - 24	2000100216 - 25	mg/kg	2170	2240	3.2
2000100217 - 24	2000100217 - 25	mg/kg	2620	2660	1.5
2000100218 - 11	2000100218 - 12	mg/kg	3050	2980	2.3
				Average RPD	3.3

RPD = ABS(X1-X2)/((X1+X2)/2)
X1 = ORIGINAL SAMPLE
X2 = DUPLICATE SAMPLE

APPENDIX B
LABORATORY DATA SHEETS

(AVAILABLE UPON REQUEST)