

Final

**Evaluation of EPA's Analytical
Data from the El Dorado Hills
Asbestos Evaluation Project**

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Abstract

In October 2004, the U.S. Environmental Protection Agency (EPA) Region IX conducted a series of tests in and around El Dorado Hills, California, to assess the potential exposure of residents to naturally occurring asbestos fibers. An EPA contracted laboratory, Lab/Cor, evaluated air samples collected during these tests to determine the presence and concentrations of asbestos fibers. The ISO 10312 analytical method was used. Another EPA contracted laboratory, TEM Asbestos Laboratory, evaluated soil samples for asbestos content. EPA released a report summarizing the results of this testing to the general public in May 2005. The study, *El Dorado Hills, Naturally Occurring Asbestos Multimedia Exposure Assessment Preliminary Assessment and Site Inspection Report Interim Final* ("El Dorado Hills Study"), concludes that asbestos fibers are present in both the soil and background air and notes exposure to elevated concentrations of asbestos fibers in connection with activity-based monitoring.

In September 2005, RJ Lee Group was contracted to conduct a peer review of the El Dorado Hills Study. Specifically, the RJ Lee Group was asked to evaluate whether the air and soil data gathered and analyzed by EPA and the contracted laboratories support the published findings, and to assess the data collected using the latest science concerning asbestos fiber definition as associated with potential health risk. As set forth fully in the attached evaluation, the RJ Lee Group makes the following findings:

1. Based on Mineralogy, Sixty-Three Percent (63%) of the Amphibole Particles Identified as Asbestos Fibers can not be Asbestos.

The EPA performed electron dispersive x-ray analyses (EDXAs) on a representative sampling of amphibole (actinolite) particles. It is well-established that particles classified as asbestiform amphiboles contain only trace quantities of aluminum. Detailed mineralogical analyses have shown that the aluminum content of asbestiform actinolite is less than 0.3 aluminum atoms per formula unit (pfu). Particles with more than 0.3 aluminum atoms pfu or about 1.5 percent Al_2O_3 cannot form in the asbestos habit due to crystal lattice constraints.

Based on a review of the EDXAs, sixty-three percent (63%) of the reported amphibole actinolite particles the El Dorado Hills Study identified as asbestos fibers contain sufficient aluminum to prevent the development of asbestiform habit (i.e., they contain more than 1.5 percent Al_2O_3). The remaining thirty-seven percent (37%) are, by virtue of their particle dimensions, also non-asbestos particles.

The selected area electron diffraction (SAED) pattern analyses performed by the EPA laboratory further corroborates that the amphibole particles collected for the El Dorado Hills study are non-asbestiform minerals. SAED data provides information on a mineral's atomic structure.

2. The Laboratory Procedures did not Comply With the NVLAP Quality Assurance Standard.

Accredited laboratories must comply with the quality assurance standard promulgated by the National Voluntary Laboratory Accreditation Program (NVLAP). The NVLAP standard limits acceptable false positives to ten percent (10%). The false positive percentage for Lab/Cor's data analyses was thirty-five percent (35%).

3. The Soil Samples do not Demonstrate the Presence of Amphibole Asbestiform Minerals.

As part of the El Dorado Hills Study, the EPA also collected soil samples in the locations where airborne testing activities were performed. TEM Asbestos Laboratories, an EPA subcontractor, analyzed the soil samples using polarized light microscopy (PLM) and concluded that the amphibole content was consistent with actinolite asbestos.

The amphibole actinolite particles reported as asbestos in the soil samples had a reported extinction angle of 12 degrees. Non-zero extinction angles are an intrinsic property of monoclinic amphibole rock fragments (non-asbestos cleavage fragments), and zero-degree extinction angles are a property of amphibole asbestos. Consequently, the amphibole particles reported in the soil samples cannot be asbestiform.

RJ Lee Group obtained splits of 23 soil samples collected from areas where the EPA activity-based sampling had indicated elevated fiber concentrations. The analyses completed by RJ Lee Group confirm that the amphibole minerals present in the soil contain elevated levels of aluminum indicative of hornblende and non-asbestos actinolite. All of the amphibole particles detected were non-fibrous cleavage fragments.

4. The ISO 10312 Analytical Method can not Distinguish Between Asbestos Fibers and Non-Asbestos Cleavage Fragments.

The El Dorado Hills Study's analytical method used to count airborne asbestos fibers, ISO 10312, cannot differentiate between asbestos fibers and non-asbestos cleavage fragments. ISO 10312 states, "The method cannot discriminate between individual fibers of asbestos and non-asbestos analogues of the sample amphibole material." As a result, EPA methodically inflated the reported asbestos concentrations with non-asbestos cleavage fragments that are not known to produce asbestos-like disease.

Furthermore, analysis of the laboratory data shows that thirty-five percent (35%) of all amphibole particles that the El Dorado Hills Study identified as amphibole asbestos fibers have aspect ratios of less than 5:1 and do not, even under the general ISO 10312 standard, meet the definition of an "asbestos fiber".

5. Applying the Latest Science And Definitional Techniques, the El Dorado Hills Study Shows no Significant Exposure to the Type of Amphibole Asbestos Fiber Connected to Health Risk.

The latest science for measuring the risk posed by asbestos is the Berman-Crump Asbestos Risk Assessment Protocol (Berman-Crump Protocol) as referenced by the Agency for Toxic Substances and Disease Registry. This protocol is the result of an EPA funded, multi-year study (revised in 2003) that demonstrates airborne amphibole asbestos fibers that are long and thin (longer than 10 micrometers (μm) and having widths that are less than 0.5 micrometers) are understood to be of most concern with respect to health risk.

In the El Dorado Hills study, EPA's contract laboratory identified 2,386 amphibole particles as amphibole asbestos fibers. Based on a review of the data, only 42 of these reported "fibers" were less than 0.5 micrometers in width and longer than 5 micrometers. Only 7 of these reported fibers were longer than 10 micrometers and less than 0.5 micrometers in width.

1. Introduction

Serpentine and amphibole minerals can be found in the bedrock of about forty percent (40%) of the United States. With the proper geological conditions, these minerals may form into long, thin fibers that could have (at one time) commercial value and would be classified as "asbestos". In California, specifically in the western foothills of the Sierra Nevada mountains and the Coast Range mountains, the bedrock contains these minerals. Within this bedrock, where the rock has undergone significant shearing or faulting, these minerals may occur as asbestos.

The El Dorado Hills region, located in the western foothills of the Sierra Nevada mountains, has experienced significant population growth over the last 40 years, resulting in extensive building development. Parts of these developments have occurred over the regions of bedrock that may contain asbestiform amphibole and chrysotile minerals, raising the residents' concerns over possible exposure to the minerals. Prior testing and evaluations of the soils have been conducted by local and state authorities and verified that amphibole and serpentine minerals are in the local soils.

At the request of a citizen, the U.S. Environmental Protection Agency (EPA) assessed the possible exposure to airborne asbestos fibers in several locations in and around El Dorado Hills in the parks and school areas. This assessment, conducted in October 2004, comprised of conducting a series of activities typical of the areas being investigated, collecting the generated airborne particles, and analyzing these particles for asbestos concentrations. In May 2005, an interim final report¹ of these assessments was issued. Figure 1-1 shows the locations of the test areas in El Dorado Hills, CA.

RJ Lee Group obtained the produced laboratory data for this assessment and has evaluated the data to determine the reliability of these analyses. RJ Lee Group also received several split samples of soil taken from the areas where activity-based air samples were collected. This report details the evaluation of these data from the testing in El Dorado Hills as well as summarizes the results of the soils testing.

1.1 Background on RJ Lee Group

RJ Lee Group, Inc., ("RJ Lee Group") has its principal office in Monroeville, Pennsylvania, and laboratories in San Leandro, California; and Manassas, Virginia. RJ

¹ Ecology and Environment, Inc. (2005). "El Dorado Hills Naturally Occurring Asbestos Multimedia Exposure Assessment El Dorado Hills, California Preliminary Assessment and Site Inspection Report Interim Final", Contract No. 68-W-01-012; TDD No.: 09-04-01-0011; Job No.: 001275.0440.01CP.

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Lee Group provides research, analytical and consulting services relating to materials characterization.²

RJ Lee Group has a long history of scientific consulting and service for government agencies, including the U.S. Environmental Protection Agency (EPA). RJ Lee Group's laboratory has served as a quality assurance and referee laboratory on a number of EPA programs and performed the analyses for the EPA's major study on airborne levels of asbestos in public buildings. RJ Lee Group has participated in the development by the EPA and American Society for Testing and Materials (ASTM) of analytical methods and procedures for asbestos analyses. The EPA requested that Dr. Richard Lee (President of RJ Lee Group) personally participate in several projects, including the drafting of the analytical portions³ of the EPA Asbestos Hazard Emergency Reduction Act (AHERA) regulations governing air sample analysis following an asbestos abatement. Dr. Lee was also a member of the literature review panel for the Health Effects Institute – Asbestos Research (HEI-AR) program that summarized the existing literature of asbestos up to 1990.

RJ Lee Group also performs analyses for the United States Navy, the United States Army and the United States General Services Administration. RJ Lee Group has developed a program to determine the cause of failure in components of the guidance system in the Trident missile for the Department of the Navy. RJ Lee Group's laboratory has also performed microscopic analyses for the State of California Air Resources Board when that agency performed testing of the air in major cities in the State of California to determine the presence of asbestos.

² Materials characterization of bulk building materials, also referred to as "constituent analysis", involves analyzing a sample of material using various techniques to identify and quantify the components of that material.

³ The TEM analytical method can be found at 40 CFR, Part 763, Appendix A to Subpart E.

2. Data Source

2.1 Laboratory Data for Air Filters

The analytical laboratory for the EPA project is Lab/Cor, Inc., located at 7619 6th Ave. NW, Seattle, WA 98117. The laboratory has various accreditations to perform asbestos testing, including the National Voluntary Laboratory Accreditation Program (NVLAP) as laboratory 10192-0. According to its web site (www.labcor.net, accessed August 13, 2005), the laboratory director is John Harris and there is one transmission electron microscopy (TEM) analyst, Dirk Wipprecht. The laboratory operates a Philips 410 transmission electron microscope (TEM).

The laboratory data was produced as a series of Adobe™ (pdf) files on two compact disks (labeled "Raw Data Summaries Group by Activity" and "Raw Data Summaries Plus Detail Grouped by Activity") sent to RJ Lee Group by Ecology and Environment, Inc. (the prime contractor on the El Dorado Hills project). The data appeared on one of two forms (shown in Figures 2-1 and 2-2), with Figure 2-1 being a summary of the sample analysis and Figure 2-2 showing the count sheet for the sample.

Each sample has three sample identifications, two of which are shown on Figures 2-1 and 2-2. The first identification is the field sample number or client sample number (AAMS-D01-092704, e.g.). The second identification is listed as the "Lab/Cor Sample No." (B 4762 S20 A1, e.g.). The third number appears on quality assurance analyses sheets and is a combination of the "Report #" (041174R5, Figure 2-1) and a portion of the Lab/Cor number. The third number is created by combining the portion of the report number before the "R" ("041174") and the numerical value after the "S" in the Lab/Cor sample number ("20"), creating "041174-20".

There were two versions of Figure 2-1 in the data set. The difference in the two versions is the classifications "PCM Equivalent Structures – US" (Figure 2-1) and "PCM Equivalent Structures – ISO" (such as in sample SFBA-H2-2FD-100504). It was assumed that these two classifications are equivalent. No explanation for this difference could be found in the May report.

Table 2-1 shows the number of samples collected (collated according to the Tables contained in the EPA's May report) and analyzed as part of this project. In addition to the two analysts identified in the Lab/Cor web site, two other analysts were identified on the laboratory data sheets – KM and TM. The total number of analyses performed by each person (including quality assurance analyses) was: DW – 94, JH – 119, KM – 152, and TM – 47.

On September 6, 2005, two additional disks were received which contained the same information as was previously received, as well as copies of recorded energy dispersive

X-ray spectra (EDXA, chemical signatures of the particles) and selected area electron diffraction pattern analyses (SAED, information on the crystal structure of the particle).

2.1.1 Analytical Procedure

The air samples collected by the EPA during the activity based testing were reportedly analyzed using the ISO 10312 analytical procedure. This procedure is applicable to the determination of airborne asbestos and for detailed evaluation of any atmosphere in which asbestos structures are likely to be the predominant particle present. Most countable particles in ambient atmospheres are not asbestos, and therefore there is a requirement for fibers to be identified. The ISO 10312 procedure uses a transmission electron microscope and counts as asbestos fibers all mineral particles from the six regulated asbestos minerals that have a minimum length of 0.5 μm and a minimum aspect ratio (the ratio of length to width) of 5:1. The analytical method does not differentiate the amphibole asbestos fibers from their non-asbestos polymorphs. This is clearly noted in the method by: "The method cannot discriminate between individual fibres of asbestos and non-asbestos analogues of the same amphibole minerals." (Section 1.1 of ISO 10312).

Lab/Cor modified the ISO 10312 analytical procedure to count mineral particles with an aspect ratio of 3:1 and greater and did not report this modification on its laboratory reports. Because of this change, a third of all amphibole particles in this study have aspect ratios less than 5:1, particles that were counted but should not have been counted by the ISO method. There is no indication of this modification to the analytical procedure on any of the produced Lab/Cor analytical reports. The May 2005 EPA report also does not mention the analytical procedure used for these studies, but does show that "AHERA-like" structures were counted that have an aspect ratio of 3:1 (see, for example, the comments on the bottom of EPA Table 5-1 on page 5-8 of the May 2005 report).

2.2 Laboratory Data for Soil Samples

Soil samples were collected at the test site concurrently with the air samples. Splits of these samples were analyzed using polarized light microscopy (PLM) by Asbestos TEM Laboratories, Inc. (<http://www.asbestostemplabs.com/>, accessed September 21, 2005). Asbestos TEM Laboratories is accredited by the NVLAP to perform asbestos analyses on bulk building materials (laboratory # 101891-0). There are two PLM microscopes at the laboratory (models Olympus BH and BH-2). The majority of the PLM analyses were performed by Steve Flexser (SF) who performed 215 analyses. A second microscopist (Mark Bailey, MB) performed 38 PLM analyses.

2.3 Data Conversion

The air sample pdf files were converted to an Excel™ format using a program called Able2Extract Professional© which performed optical character recognition on the scanned images in the provided pdf files. After conversion, the data were reviewed to correct errors in conversion and to create a consistent file format. There are a total of 317 samples, 57 quality assurance (QA) analyses, and 65 pending samples. [Note: these numbers may not match those shown in Table 2-1 due to duplication of samples in the various report tables.]

The EDXA and SAED data were entered into spreadsheets for later evaluation.

3. Analysis of El Dorado Hills Air Samples

3.1 Reported Concentrations

A large number of mineral particles were reported by Lab/Cor. Table 3-1 shows the number of particles counted in each activity that were identified as asbestos fibers (count sheet codes "F", "CF", and "MF").⁴

Lab/Cor reported concentrations for several different size classifications of mineral particles. Of interest are three classifications:

Primary Structures: any structure that contains (at a minimum) a mineral particle that is at least 0.5 μm long with a minimum aspect ratio of 3:1.

PCME Asbestos Structures: particles that are phase contrast microscopy equivalent (PCME) in size: longer than 5 μm , at least 3:1 aspect ratio, and wider than 0.25 μm .

*Protocol Structures*⁵: particles longer than 5 μm and thinner than 0.5 μm . The Protocol structures are further divided into chrysotile and amphibole categories, as well as into two length classifications: 5 μm – 10 μm and ≥ 10 μm .

The first group is simply the total number of particles counted. The other two groups are size classes used (or proposed for use) in risk analyses.

Table 3-2 shows the reported concentrations for all mineral particles in for these three classifications (these samples exclude field blanks, filter blanks, performance samples, and quality control analyses). Samples with no reported fibers were calculated using "0" as the concentration in accordance with statistical theory.⁶ The median concentrations were 0.0040 s/cc (primary structures), 0.0010 f/cc (PCME structures),

⁴ Chrysotile fibers were observed in air samples generally associated with activities on the ball fields. The median chrysotile concentration is <0.0001 for all three size classifications, indicating the majority of samples contained no chrysotile. The highest chrysotile concentrations were associated with the activities at the Community Park south baseball field. More than seventy percent (70%) of samples with statistically significant chrysotile counts were associated with baseball field activities. Less than two percent of the chrysotile structures were longer than 5 μm . The focus of this report will be on the reported amphibole particles.

⁵ D. Wayne Berman and K. S. Crump (2003). "Final Draft: Technical support document for a protocol to assess asbestos-related risk," U.S. Environmental Protection Agency, Peer-reviewed consultation held in San Francisco on February 25-26, 2003.

⁶ Oehlert, G. A; Lee, R. J.; and Van Orden, D. R. (1995). "Statistical Analysis of Asbestos Fibre Counts", *Environmetrics*, 6, p. 115 - 116.

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and 0.0 f/cc (protocol structures). Asbestos fibers longer than 5 μm have historically been related to fibrogenicity and carcinogenicity.⁷

A statistically insignificant number of protocol fibers were counted by Lab/Cor. Table 3-3 summarizes these counts.

Statistical comparisons for each activity comparing personal, area, and reference area (background) protocol fiber concentrations show no difference among the types of samples or between personal and reference concentrations. Protocol structures (those mineral fibers that are 10 μm and longer and thinner than 0.5 μm) have been shown to be useful in cancer risk estimation. When these concentrations are examined on an activity basis, Tables 3-4 and 3-5, there are no statistically significant differences in concentrations. Protocol fibers were detected during six activities on the personal samples and in only one set of reference samples; however there is no significant difference in concentration, regardless of whether the comparisons are made on an activity-basis or over the combined data.

The median concentrations for these size classifications are not significantly different than background concentrations. One study from 1984⁸ indicates the national average to be 0.0004 f/cc for fibers longer than 5 μm . The Health Effects Institute-Asbestos Research report⁹ indicates the background airborne concentrations for PCME fibers to range from 0 – 0.008 f/cc. These numbers are not statistically different than the median for the El Dorado Study (0.0010 f/cc).

3.2 Mineral Particle Identification

Large numbers of mineral particles were enumerated on the laboratory count sheets. Including quality control test samples, 6873 mineral particles¹⁰ were enumerated, of which 5624 particles were counted during the original sample analyses, 779 during quality assurance testing, and 470 on five samples labeled as "performance" samples. There were 3948 amphibole and 2925 chrysotile structures counted in the original analyses.

The principle amphibole particle reported was actinolite (a very small number of other amphibole mineral particles were reported). Nearly seventy-two percent (72%) of

⁷ Agency for Toxic Substances and Disease Registry (2002). "Expert Panel on Health Effects of Asbestos and Synthetic Vitreous Fibers (SVF): The Influence of Fiber Length; Premeeting Comments", October 29-30, 2002, New York, NY.

⁸ National Research Council (1984). *Asbestiform Fibers: Nonoccupational Health Risks*, National Academy Press.

⁹ HEI-AR (1991). *Asbestos in Public and Commercial Buildings: A Literature Review and Synthesis of Current Knowledge*, p. 4-38 to 4-39.

¹⁰ Each line of data on the count sheets has been counted as a separate entry for the overall number of particles counted.

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3071¹¹ actinolite particles (those with some information on the chemical composition of the particle) contained aluminum. This is a very significant finding because aluminum is a minor component of actinolite. Examples of the observed chemistries are shown in Figure 3-1.

The mineral actinolite has a defined chemical composition that may contain only a very small amount of aluminum. Changes to the chemical composition will distort the crystal structure of the mineral, eventually (with sufficient chemical substitution) resulting in a different mineral structure. According to Leake et al¹² and Deer, Howie and Zussman¹³, the aluminum content of asbestiform actinolite is restricted to < 0.3 aluminum atoms pfu (per formula unit)¹⁴. Actinolite with aluminum compositions above 0.3 Al pfu have aluminum concentrations too high to form asbestos fibers. As noted by Deer Howie and Zussman (page 182), "specimens that contain more than a very small amount of aluminum do not have an asbestiform habit". Verkouteren found a maximum of 1.5 percent Al₂O₃ or 0.26 pfu in a recent analysis of 34 actinolite asbestos samples, but estimated that under some circumstances, when aluminum substitutes for silicon in the tetrahedral site, and certain other cations are present, non-asbestos actinolite could contain as much as 1.0 pfu and still conform to the Leaky nomenclature.^{15,16} Dorling¹⁷ examined one actinolite asbestos sample as part of a general evaluation of the characteristics of calcic amphiboles. The aluminum content of the sole asbestiform actinolite sample was 0.25 percent Al₂O₃.

Using the Verkouteren observation of 1.5 percent, based on the reported chemistries, sixty-three percent (63%) of the reported actinolite particles have been misclassified as asbestos. Table 3-6 summarizes the EDXA data reported for the actinolite particles. There are 341 particles that were identified as actinolite on the basis of the chemical composition identified by the EDXA. As shown in the Table, the aluminum content of the reported actinolite particles ranged from no aluminum up to 8.7 percent Al₂O₃. Only seven percent (7%) of the spectra report no aluminum; the median aluminum content is two percent Al₂O₃ (2%), and sixty-three percent (63%) exceeded 1.5 percent Al₂O₃.

Sixty-three percent (63%) of the reported actinolite particles cannot be asbestos fibers due to the excessive amounts of aluminum reported by the laboratory. The EDXA

¹¹ There were 3071 reported actinolite particles with some information on the particle's chemical composition.

¹² B. E. Leake et al (1997). "Nomenclature of Amphiboles: Report of the Subcommittee on Amphiboles of the International Mineralogical Association, Commission on New Minerals and Mineral Names", *American Mineralogist*, **82**, p. 1019-1037.

¹³ W. A. Deer, R. A. Howie, and J. Zussman (1997). *Rock-Forming Minerals: Double-chain silicates*, Vol 2, second edition, p 137 – 145.

¹⁴ 0.3 aluminum atoms pfu is equivalent to < 2% Al₂O₃ when the content is reported as oxide compounds.

¹⁵ J. R. Verkouteren and A. G. Wylie (2000). "The tremolite-actinolite-ferro-actinolite series: Systematic relationships among cell parameters, composition, optical properties, and habit, and evidence of discontinuities", *American Mineralogist*, **85**, p. 1239 – 1254.

¹⁶ The maximum reported Al₂O₃ content of the 103 samples reported by Verkouteren was 4.3% found in a byssolitic (non-asbestos) actinolite sample.

¹⁷ M. Dorling and J. Zussman (1987). "Characteristics of asbestiform and non-asbestiform calcic amphiboles", *Lithos*, **20**, p. 469 – 489.

compositional data for the reported actinolite particles are shown in Figure 3-2. In this graph, the iron (Fe), magnesium (Mg), and aluminum (Al) from each of the analyses are shown (the aluminum scale has been expanded for clarification). Sixty-three percent exceed 1.5 percent Al_2O_3 .

3.3 Mineral Particle Size Analysis

There are 2386 amphibole particles identified as single amphibole asbestos fibers (codes "F", "MF", or "CF") on the original analyses. These "fibers" represent the amphibole minerals that were counted as single entities (not bundles of fibers or other complex structures) and represent the basic structures that were observed in the airborne samples. The average dimensions of these particles (of all lengths), shown in Table 3-7, indicate they are 5.3 μm long with a width of 0.8 μm and an aspect ratio of about 6:1.

These dimensions demonstrate the amphibole particles to be a population of non-asbestos particles. This distribution is shown in Figure 3-3 which is a plot of particle length vs. particle width. The plot shows a general trend toward longer and thicker particles (lower left to upper right in the graph), an indicator of a non-asbestos particle distribution.

Analysis of the laboratory data shows that thirty-five percent (35%) of all amphibole particles that the El Dorado Hills Study identified as amphibole asbestos fibers have aspect ratios of less than 5:1 and do not, even under the general ISO 10312 standard, meet the definition of an "asbestos fiber."

The dimensions of the particles 5 μm and longer do not conform to the recommended EPA¹⁸ definition of asbestos which says the average aspect ratio is 20:1 or more. Table 3-8 shows the dimensions for these "fibers". With an average aspect ratio of only 6.3:1, these dimensions are not indicative of an asbestos population as defined by the US Environmental Protection Agency.^{19,20}

When compared with true asbestos fibers, the particles from El Dorado Hills are much wider. Figure 3-4 shows the Jamestown²¹ amphibole asbestos to be much thinner than the El Dorado Hills amphibole particles.

¹⁸ U.S. Environmental Protection Agency (1993). "Test Method: Method for the Determination of Asbestos in Bulk Building Materials", EPA/600/R-93/116, p. A-1.

¹⁹ M. E. Beard (1992). Letter to Sally Sasnett, November 3, 1992. Asbestos fibers have mean aspect ratios "ranging from 20:1 to 100:1" for fibers longer than 5 μm .

²⁰ U.S. Environmental Protection Agency (1993). "Method for the Determination of Asbestos in Bulk Building Materials", EPA 600/R-93/116.

²¹ J. M. G. Davis, J. Addison, C. McIntosh, B. G. Miller, and K. Niven (1991). "Variations in the Carcinogenicity of Tremolite Dust Samples of Differing Morphology", *Annals of New York Academy of Sciences*, 643, p. 473 – 490.

3.4 The Amphibole Particles are not From an Asbestos Population

As noted in the definition of asbestos presented in an EPA analytical procedure, an asbestiform population is characterized by: a) mean aspect ratios of 20:1 or greater for fibers 5 μm and longer; b) fiber widths less than 0.5 μm ; and c) parallel fiber occurring in bundles. The reported particles fail to meet the aspect ratio and width specifications for asbestiform populations as shown in Table 3-8. In fact, only 36 particles $\geq 5 \mu\text{m}$ in length (three percent of particles $\geq 5 \mu\text{m}$) have aspect ratios greater than 20:1 and only 50 of the particles $\geq 5 \mu\text{m}$ in length (four percent of the particles $\geq 5 \mu\text{m}$ in length) are thinner than 0.5 μm . Only seven fibers (0.3 percent of all amphibole fibers) are $\geq 10 \mu\text{m}$ in length and thinner than 0.5 μm , a class of fibers used in recent risk models (the Berman-Crump model).

Within the data set, there were 85 amphibole bundles counted during the original analyses. The ISO 10312²² analytical method used by Lab/Cor defines a "bundle" as "a grouping of apparently attached parallel fibres". Thus a bundle is composed of (at a minimum) of two (2) fibers, however there are usually more. The average dimensions of the bundles are shown in Table 3-9. The reported width of a bundle is the overall width of the bundle and not the width of the component fibers.

Fiber bundles are a basic characteristic of asbestos. The dimensions of the bundles can be used to estimate the maximum widths of the asbestos fibers in this study. Assuming a bundle contains a minimum of two (2) fibers, the maximum width of the asbestos amphibole fiber dislodged from a bundle would be 0.4 μm . This is an extremely conservative estimate since asbestos bundles typically contain more than two fibers. In the EPA data, the vast majority of particles (eighty percent, 80%) are greater than 0.5 μm in width. If there was a significant asbestos population, there would be significantly more thin fibers than what the sample data indicate.

The vast majority of the amphibole particles counted in this study are non-asbestiform. True amphibole asbestos fibers are characterized by widths of 0.2 to 0.4 μm ; amphibole particles wider than 0.5 μm are non-asbestos particles. There are 1901 amphibole particles (excluding bundles) that are 0.5 μm and wider or eighty percent (80%) of the amphibole particles. For particles 5 μm and longer, 1273 (ninety-six percent, 96%) of these particles are $\geq 0.5 \mu\text{m}$ wide. Figure 3-5 shows some of the particles observed by Lab/Cor that are non-asbestos in habit but were reported as asbestos. None of these particles illustrate asbestos characteristics: parallel sides, high aspect ratio, and proper termination (ends of the fibers).

The diffraction pattern analyses performed by Lab/Cor support the labeling of these particles as non-asbestos. Lab/Cor produced evaluations of the selected area electron diffraction (SAED) data that provides information related to the crystal structure of a mineral. Zone axis SAED patterns are one indicator for whether a particle is

²² International Organization for Standardization (1995). "Ambient Air – Determination of asbestos fibres – Direct-transfer transmission electron microscopy method", ISO 10312.

asbestiform or not. Ring²³ has shown asbestos fibers are generally associated with lower order zone axis patterns (such as [0 X X] or [1 X X]), while non-asbestiform particles generally have higher order zone axis patterns (usually $[\geq 3 X X]$).^{24,25} The higher order zones are also those that have a possibility of matching other minerals due to the (relatively) large error associated with the measurements. The produced data listed the mineral identification, the matching crystal zone index (the zone that best fit the SAED pattern), and the reported zone index for the pattern. Table 3-10 summarizes the number of patterns for each identified mineral and the number of times the matched zone was reported as the zone axis for the pattern. When the reported zone axis is not the match zone, the analyst has incorrectly analyzed the pattern. The majority of the identified zone axis SAED patterns are higher order patterns, indicative of non-asbestos minerals.

3.5 Quality Assurance Testing

Lab/Cor re-analyzed a number of samples as part of an overall quality assurance test program. Of interest are the re-analyses that were performed on the same grid openings as were originally analyzed. The comparison of these two sets of count sheets permits an estimation of the accuracy of the original analysis. There were two groups of these analyses: 1) the original and one quality assurance test; and 2) the original and two quality assurance analyses. The first group permits an estimation of the overall accuracy of the counting; the second group provides information on the cause of the different counts.

Paired Analyses: Within the produced data, 16 samples had a second analysis performed on the same grid openings as were analyzed in the original analysis, permitting an estimate of the true counting rate by the laboratory analysts. Because there is no way to independently verify the actual analysis, it was assumed that a reported mineral particle is a true count when reported by both the original and quality assurance analyses. The remaining structures represent miscounts by either the original analyst (that is, a particle was observed in the original analyses but not reported in the quality assurance analysis) or by the quality assurance analyst (a fiber not reported in the original analysis but reported in the quality assurance analysis). Table 3-12 summarizes these data; the 16 sets of data are attached in Appendix 1. For this analysis, the counts are based on the number of primary structures counted.

The data shown in Table 3-11 indicate the original mineral particle counts are inflated, on average, about seventy-eight percent (78%) above the agreed upon number of

²³ S. J. Ring (1980). "Identification of Amphibole Fibers, Including Asbestos Using Common Electron Diffraction Patterns", draft report dated March 31, 1980.

²⁴ R. J. Lee, J. S. Lally, and R. M. Fisher (1978). "Identification and Counting of Mineral Fragments", in *Proceedings of the Workshop on Asbestos: Definitions and Measurement Methods*, National Bureau of Standards, July 18 – 20, 1977, Special Publication 506, p. 387-402.

²⁵ A. M. Langer, R. P. Nolan, J. Addison (1991). "Distinguishing Between Amphibole Asbestos Fibers and Elongate Cleavage Fragments of Their Non-Asbestos Analogues", in *Mechanisms in Fibre Carcinogenesis*, p. 253-267.

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particles on each sample. The only explanation for the complete failure to verify the presence of a fiber in the original analyses on two of these samples (RHB-H2-3FD-100304 and SRA-R02-100604) is that the analysts must have counted different grid openings (even though the count sheets indicate otherwise).

Original and Two Quality Assurance Analyses: Three samples (NRA-R02-101104, SRA-R05-100604, and CC2-H8-1CT-100304) were analyzed three times on the same grid openings. The third analysis provides an opportunity to estimate the False Positive and False Negative percentages for an analysis. For this evaluation, a True Positive is defined as two out of the three analyses reporting a particle. A False Positive is only one of the three analyses reporting a particle. A False Negative was not reporting a structure observed in the other two analyses of the grid opening. Table 3-12 summarizes these data. As a reference for evaluating True Positives, False Negatives, and False Positives, proficient analysts at NVLAP accredited laboratories are expected to have rates in excess of eighty percent (80%) for True Positives, less than twenty percent (20%) for False Negatives, and less than ten percent (10%) for False Positives.²⁶

The reported data had an average False Positive Rate of thirty-five percent (35%), far exceeding the NVLAP guideline of less than ten percent (10%).

All of these "same grid opening" analyses were incorrectly determined to be of acceptable quality by Lab/Cor. Lab/Cor determined whether an analysis was acceptable or not by comparing the number of particles counted in the second analysis to the Poisson confidence interval for the original count.²⁷ The use of Poisson counting statistics is acceptable when comparing the data from different areas of the filter, but it is not an acceptable procedure when the same grid openings are examined. Poisson statistics are used to account for the distribution of fibers on the filter. However, when the same areas of the filter are analyzed multiple times, the issue of variable fiber distribution is no longer in question, rather whether the same fibers are counted or not.

Further evaluation of the QA data show that the total number of QA analyses were less than generally accepted (eight percent [8%] versus ten percent [10%]) and that the QA was not even performed during much of the project (thirty-eight percent [38%] of the sample data had no QA analyses associated with the samples).

3.6 Blank Samples

Within each set of data, several samples were reported as either a "Field Blank" or a "Filter Blank". All of these filters were shown to be free of mineral particles. However, with few exceptions, all of these "Blank" samples were reported to have a volume of air sampled. The EPA report did not describe the purpose of samples labeled as "Blank"; it

²⁶ NVLAP (1995). Airborne Asbestos Analysis, NIST Handbook 150-13, item 3.7.d, page C-6.

²⁷ A summary page, dated 1/4/2005, of the original and quality control analyses was included in the materials received on September 6, 2005.

cannot be determined what air was sampled by these filters. By definition, a blank has no air filtered through the sample. This traditional definition is reflected in the various analytical methods (such as ISO 10312, AHERA, and NIOSH 7400) used for asbestos exposure analyses.

A summary of the "blank" filters is shown in Table 3-13.

3.7 Air Sample Volumes

For many of the samples, the volume of sampled air exceeded 2500 L. Prior studies (such as EPA/560/5-88-002, *Assessing Asbestos Exposure in Public Buildings*) have shown that sampling high volumes of air resulted in filters with excessive particulate that prevented precise and accurate counts of the asbestos fibers. Because high particulate loads may bias the analytical results, the National Voluntary Laboratory Accreditation Program (NVLAP) has restricted acceptable particle loadings to less than ten percent (10%) coverage on the filter's surface.²⁸ Because the samples in the El Dorado study were collected outdoors, it is highly likely that the particulate loading on the samples with air volumes in excess of 2500 L exceed the accepted ten percent (10%) limit. The overall particle loading on a filter was not reported by Lab/Cor.

3.8 Transcription Discrepancies in Laboratory Data Sheets

While reviewing the laboratory data sheets, a number of transcription errors were noted, leading to a six percent (6%) error rate. The following Table 3-14 lists these errors.

The majority of these errors appear to result from incorrect transcription of written data to computer format, however without the written count sheets this conclusion cannot be confirmed.

There were 351 analyses (excluding quality assurance tests and pending results) reported in the May report. With 22 observed transcription errors (Table 3-15), this amounts to a six percent (6%) error rate.

There was also a discrepancy in the reported PCM-equivalent structure concentration for sample CC2-L6-3CC-100304. In the EPA report, Table 5-9 shows a concentration of 0.00491 s/cc while Table 5-10 shows 0.00393 s/cc for the same sample. The correct concentration is 0.00393 f/cc.

²⁸ The NVLAP guideline may be found at http://ts.nist.gov/ts/htdocs/210/214/docs/lb_7_2002.pdf.

4. Analysis of El Dorado Hills Soil Samples

Soil samples were collected in the locations where test activities were performed. These samples were analyzed by TEM Asbestos Laboratories, Inc. in April-May, 2005; the data from these analyses were received on September 21, 2005.

4.1 Soil Sample Results²⁹

The analytical data incorrectly reports the amphibole content of the soil samples as actinolite asbestos. Asbestos TEM Laboratories analyzed the samples reportedly in accordance with the polarized light microscopy (PLM) method NIOSH 9002.³⁰ The data are internally consistent – all field samples were determined to contain some amount of actinolite (either "<1%" or "1 – 5%") and no chrysotile. The reported actinolite in all samples had the following optical properties: green color; green/dark green pleochroism; parallel refractive index – 1.672; perpendicular refractive index – 1.652; moderate birefringence; positive sign of elongation; and a 12° extinction angle³¹. All of the actinolite was described as having a morphology of "needles".

The reported optical properties are descriptive of non-asbestos minerals ("Needles" and inclined extinction). As noted in Campbell et al³², needles are acicular structures from single crystals, not asbestos.

Parallel extinction is a primary indicator in the polarized light microscope that the observed fiber may be asbestos. The NIOSH method indicates that tremolite/actinolite fragments (not asbestos fibers) have inclined extinction (Table 1 in method). OSHA³³ indicates tremolite and actinolite non-asbestos particles "show inclined extinction under cross polars with no compensator. Asbestos fibers usually show extinction at zero degrees or ambiguous extinction if any at all." Figure 4-1 illustrates the extinction of the amphibole particle from El Dorado Hills and compares it to the extinction of a tremolite asbestos from Korea and an asbestos amphibole from Jamestown.

²⁹ The soil sample data reviewed by RJ Lee Group are data from TEM Asbestos Laboratories, Inc. There is a report from Ecology and Environment (dated July 20, 2005) indicating an earlier set of analyses on the samples was performed by EMSL, Inc. The EMSL data was not available for review.

³⁰ The method can be found at <http://www.cdc.gov/niosh/nmam/pdfs/9002.pdf>.

³¹ Extinction – in the polarized light microscope with crossed polarizing filters, a particle will appear to go "extinct" or black (no light passes through the particle) when the optical axes of the particle are parallel to those of the polarizing filters. Asbestos fibers will have parallel extinction.

³² W. J. Campbell, et al (1977). "Selected Silicate Minerals and Their Asbestiform Varieties", U.S. Department of the Interior, Bureau of Mines, Information Circular 8751.

³³ OSHA (1992). "Polarized Light Microscopy of Asbestos", Method ID-191.

4.2 Split Soil Samples

RJ Lee Group received 23 soil samples from Youngdahl Consulting Group on Friday, August 26, 2005. These samples were split samples, collected by Ecology & Environment during their September/October 2004 testing at El Dorado Hills. The samples analyzed by RJ Lee Group were collected near areas where the EPA activity-based sampling had reported high airborne particle concentrations. All of the samples were analyzed using standard optical microscopy techniques; seven of the samples were selected by RJ Lee Group for additional analyses. These seven represent the various types of soil expected to be found in the test locale: the nature trail (three samples), a baseball infield sample (one), and grass-covered fields (three samples). Table 4-1 lists the samples that were received, their general location, the analyses performed on the samples by RJ Lee Group, as well as the analytical results for those samples determined by TEM Asbestos Laboratories (see Section 4.1 of this report). Aerial photographs of the samples locations that were published on the Internet are included in Appendix 2.

The samples contained no asbestiform amphibole minerals when analyzed by polarized light microscopy (PLM). One sample (EDH-ZP-3-100704) contained non-asbestiform tremolite (extinction angles approximately 20°) as well as some chrysotile. Hornblende was observed by PLM in the remaining samples. The hornblende was observed at varying concentrations as short, blocky particles (low aspect ratio) with no striations along the long particle axis (striations are used to optically differentiate actinolite from hornblende). The hornblende was observed to have inclined extinction angles (10 - 20°), indicative of a non-asbestiform crystal.

Several of the samples were examined using X-ray powder diffraction (XRD). These analyses confirmed the presence of amphibole particles in the samples at concentrations ranging from one to three percent (1-3%: JSS-S04-101004-FG2), three to five percent (3-5%: CPS-S05-100804-FG2, NYT-SF1-100804-FG2), five to ten percent (5-10%: NYT-SA1-100804-FG2, NFB-SS04-100804-FG2), and ten to fifteen percent (10-15%: NYT-SJ3-100804-FG2). XRD does not differentiate between hornblende and actinolite.

No asbestiform amphibole particles were observed during RJ Lee Group's analyses. The soil samples were examined in a scanning electron microscope to evaluate general particle morphology and to determine the range of EDXA chemistries observed on suspected amphibole particles. Examples of the particles observed in these analyses are shown in Figures 4-2 and 4-3. Each of these samples shows an elongated amphibole particle that is non-asbestiform. These Figures are typical of the amphibole particles observed in the soil samples.

As noted in Table 4-1, several samples were examined using transmission electron microscopy (TEM). These analyses indicate the samples contained both hornblende and actinolite, all in non-asbestos habit.

Figures

Final

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report # 041174R5

Client: Ecology and Environment, Inc.

Project Name: Site# 0440.01CP, 0440.01CP-0010-FINAL RESULTS

ANALYSIS DETAIL

Lab/Cor Sample No. B4762 S20 A1
 Client Sample No. AAMS-D01-092704
 Description
 Analysis Date 1/2/2005
 Analyst KM

Volume (L) 6182.8
 No. of Grid Openings 15
 Filter Area (mm²) 385
 Area Analyzed (mm²) 0.217
 Analytical Sens. (struc/cc) 0.000286
 Detection Limit. (struc/cc) 0.000857

Structure Type	Filter Density (s/mm ²)	Concentration (struc/cc)	95% Confidence Interval (struc/cc)	Struc. Count
Primary Asbestos Structures	27.6	0.00172	0.000631 - 0.00374	6
Total Asbestos Structures	27.6	0.00172	0.000631 - 0.00374	6
Asbestos Structures > 5um	18.4	0.00115	0.000312 - 0.00293	4
Asbestos Fibers and Bundles > 5um	18.4	0.00115	0.000312 - 0.00293	4
PCM Equivalent Fibers-US	18.4	0.00115	0.000312 - 0.00293	4
PCM Equivalent Structures-US	18.4	0.00115	0.000312 - 0.00293	4
PROTOCOL ASB STRUCS 5-10	0.0	<0.000857	0.00 - 0.000857	0
PROTOCOL ASB STRUCS >10	0.0	<0.000857	0.00 - 0.000857	0
PROTOCOL ASB STRUCS TOTAL	0.0	<0.000857	0.00 - 0.000857	0
PROTOCOL CHRYS STRUCS 5-10	0.0	<0.000857	0.00 - 0.000857	0
PROTOCOL CHRYS STRUCS >10	0.0	<0.000857	0.00 - 0.000857	0
PROTOCOL CHRYS STRUCS TOTAL	0.0	<0.000857	0.00 - 0.000857	0
PROTOCOL AMPH STRUCS 5-10	0.0	<0.000857	0.00 - 0.000857	0
PROTOCOL AMPH STRUCS >10	0.0	<0.000857	0.00 - 0.000857	0
PROTOCOL AMPH STRUCS TOTAL	0.0	<0.000857	0.00 - 0.000857	0
AHERA-like Total Structures 3:1	27.6	0.00172	0.000631 - 0.00374	6
AHERA-like Asb Strucs >5 and 3:1	18.4	0.00115	0.000312 - 0.00293	4
AHERA-like Asb Strucs 5 - 10 and 3:1	9.2	0.000573	0.00 - 0.00180	2
AHERA-like Asb Strucs >10 and 3:1	9.2	0.000573	0.00 - 0.00180	2
Total Other Amphibole Strucs 3:1	0.0	<0.000857	0.00 - 0.000857	0
Other Amphibole Strucs >5 and 3:1	0.0	<0.000857	0.00 - 0.000857	0
Other Amphibole Strucs 5 - 10 and 3:1	0.0	<0.000857	0.00 - 0.000857	0
Other Amphibole Strucs >10 and 3:1	0.0	<0.000857	0.00 - 0.000857	0

Figure 2-1. An example of a summary sheet for a transmission electron microscopy analysis of a sample from El Dorado Hills.

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Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report # 041174R5

Client: Ecology and Environment, Inc.

Project Name: Site# 0440.01CP, 0440.01CP-0010-FINAL RESULTS

TEM ASBESTOS STRUCTURE COUNT - RAW DATA

Sample No.: AAMS-D01-092704

Lab/Cor Sample No.: B4762 S20 A1

Descripton:

Gr	No.	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	Neg#	EDS#	Comment	Count Categories
A	1	B21	AQ	1	1	F	3.2	0.7	4.6			Mg, Al, Si, Ca, Fe Actinolite	TAS_AHRA
A	1	B21	AQ	2	2	F	9.5	1.2	7.9			Mg, Al, Si, Ca, Fe Actinolite	AS>5, AFB>5, PCMEF-US, PCMES-US, TAS_AHRA, AS>5_AHRA, AS5-10_AHRA
A	2	B41				NSD							
A	3	B1				NSD							
A	4	C11				NSD							
A	5	A31				NSD							
A	6	A11				NSD							
A	7	D1				NSD							
A	8	D21				NSD							
A	9	C20				NSD							
B	10	A31				NSD							
B	11	A11				NSD							
B	12	D1	AQ	3	3	F	5.5	1.5	3.7			Mg, Al, Si, Ca, Fe Actinolite	AS>5, AFB>5, PCMEF-US, PCMES-US, TAS_AHRA, AS>5_AHRA, AS5-10_AHRA
B	12	D1	AQ	4	4	F	19.5	1.2	16			Mg, Al, Si, Ca, Fe Actinolite	AS>5, AFB>5, PCMEF-US, PCMES-US, TAS_AHRA, AS>5_AHRA, AS>10_AHRA
B	13	D21				NSD							
B	14	D41	AQ	5	5	F	19	3	6.3			Mg, Al, Si, Ca, Fe Actinolite	AS>5, AFB>5, PCMEF-US, PCMES-US, TAS_AHRA, AS>5_AHRA, AS>10_AHRA
B	15	A42	AZQ	6	6	F	4.3	0.5	8.6	1267	924	Mg, Al, Si, Ca, Fe Actinolite Zone Axis [1 0 0] - KM	TAS_AHRA

Figure 2-2. An example of a sample count sheet from a transmission electron microscopy analysis of a sample from El Dorado Hills.

Final

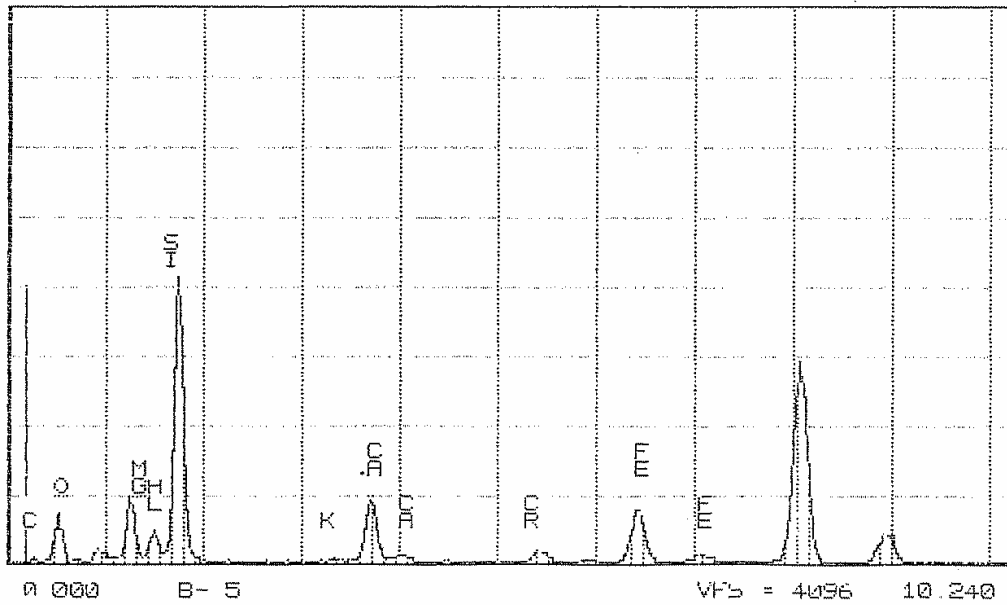
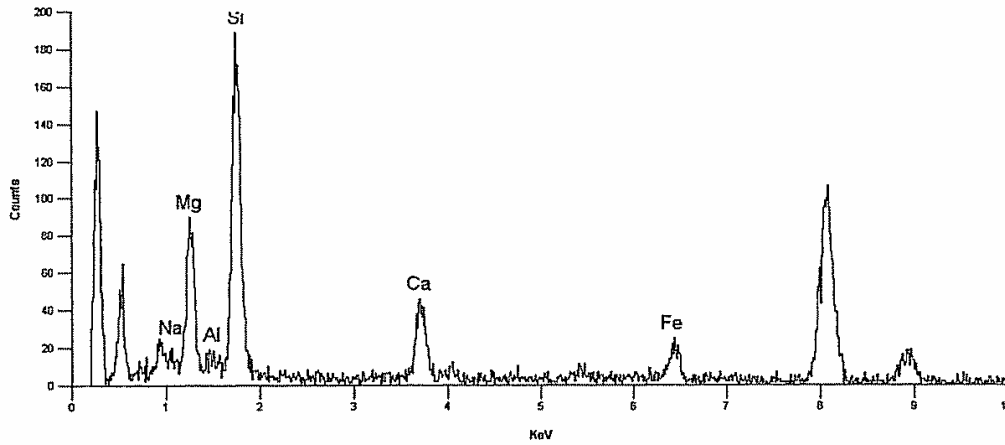


Figure 3-1. Representative EDXA spectra obtained during analyses of mineral particles from El Dorado Hills. The data were part of the supplementary information received by RJ Lee Group on September 6, 2005. The upper spectrum reportedly contains 3.96% Al_2O_3 while the lower spectrum reportedly contains 7.78% Al_2O_3 .

Final

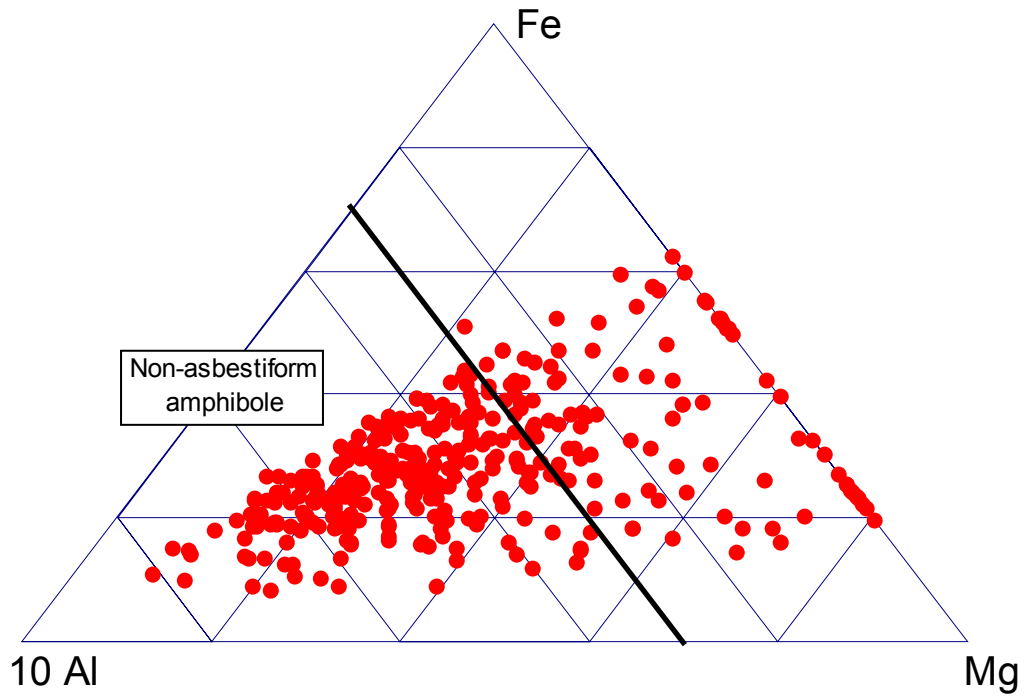


Figure 3-2. A graphical representation of the aluminum (Al), magnesium (Mg), and iron (Fe) content of the 341 reported actinolite particles from the El Dorado Hills EDXA data set. The aluminum scale has been expanded for clarification. The line shows the approximate location of 1.5 percent Al_2O_3 .

Final

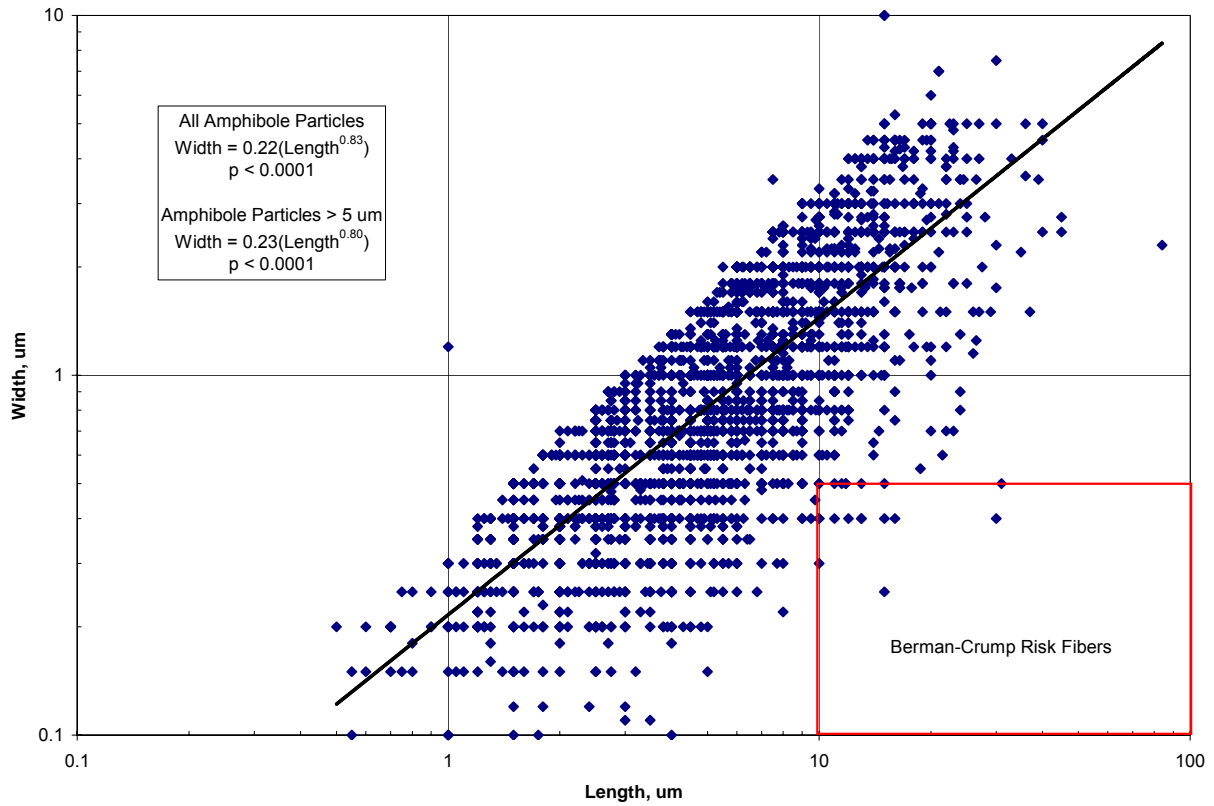


Figure 3-3. This graph shows the relationship between the amphibole particle length and width. This dimensional relationship is indicative of a non-asbestos population of mineral particles. The red block shows the location of the fiber dimensions used for risk estimation. The p-values shown in the graph indicate the regressions are statistically significant.

Final

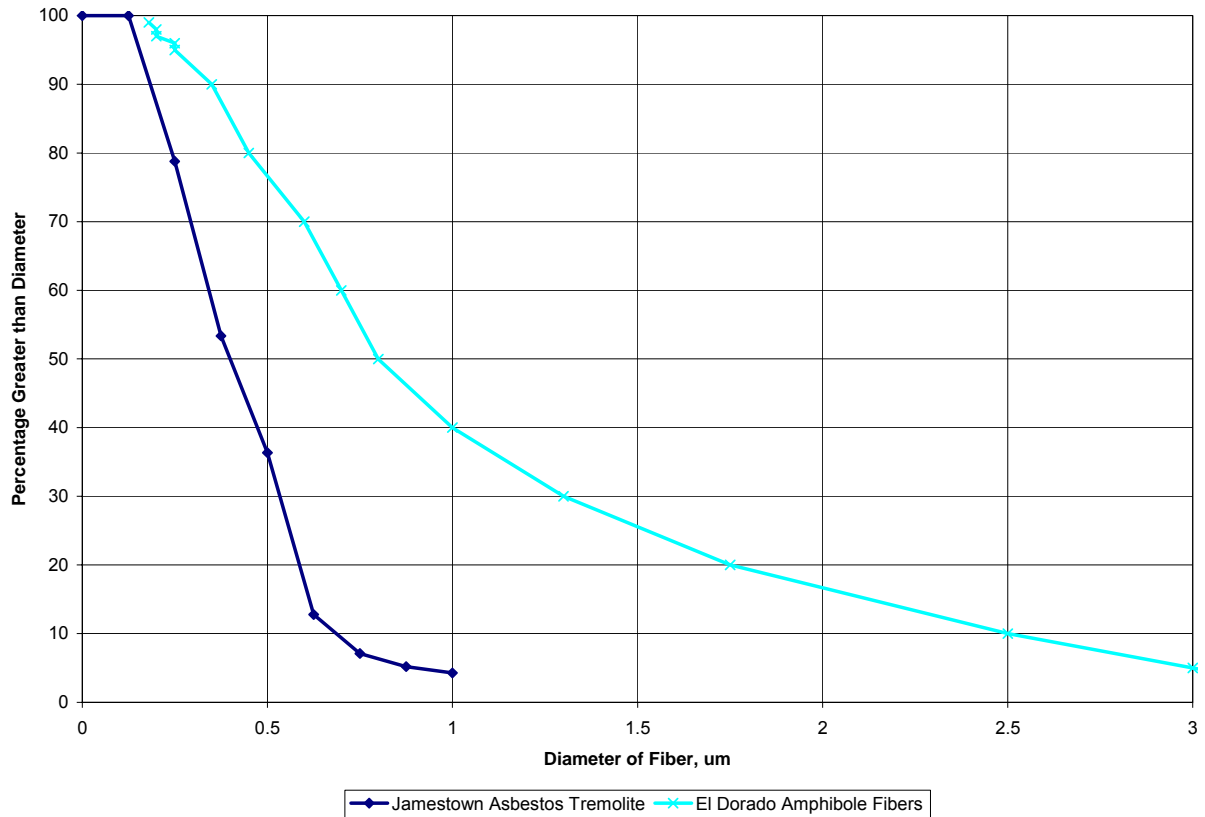
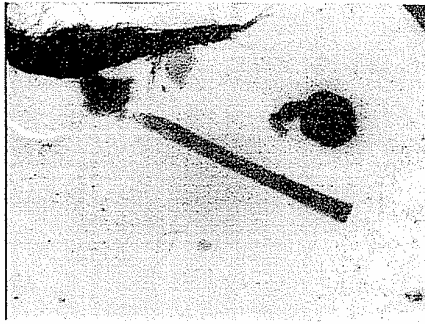
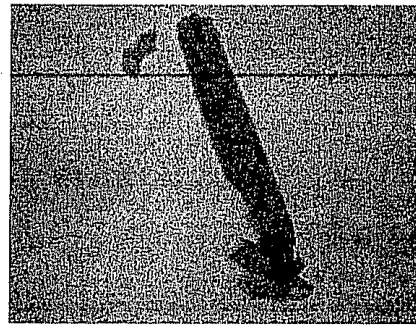


Figure 3-4. A comparison of the width distributions of amphibole particles 5 μm and longer observed in El Dorado Hills (light blue) with those observed in tremolite asbestos from Jamestown (dark blue).

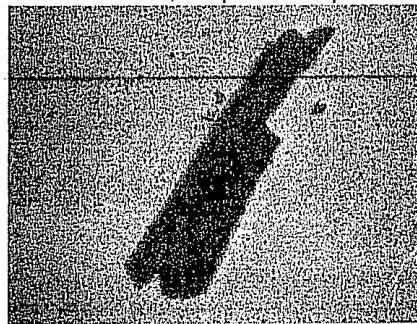
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Sample AAMS-D09-100504, #5,
Actinolite, 12 μm x 0.8 μm



10200 : 1
2 μm
Sample SRA-R03-100704, #4,
Actinolite, 4.8 μm x 0.65 μm



11800 : 1
2 μm
Sample NRA-R05-101004, #1,
Actinolite, 5.2 μm x 1.2 μm

Figure 3-5. Actinolite "fibers" observed by Lab/Cor on indirectly prepared samples. All of these particles are non-asbestiform: non-parallel sides and poor end termination are characteristic of the non-asbestos particles.

Final

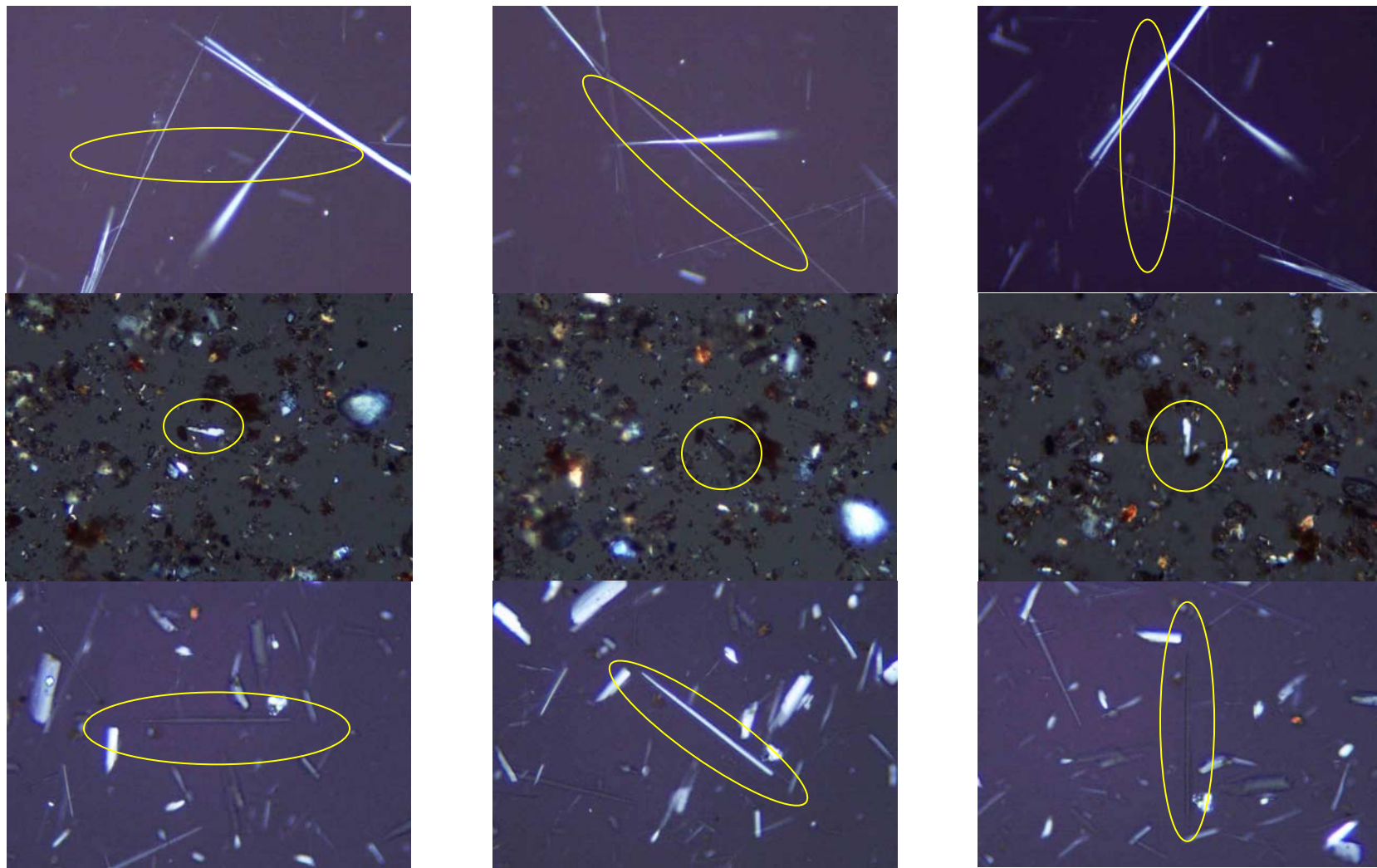


Figure 4-1. Photographs showing the extinction of particles of Jamestown tremolite (top), El Dorado amphibole (middle), and Korean tremolite (bottom). The pictures are shown with the particle in a horizontal position (left), angled (middle column), and in a vertical orientation (right). Extinction occurs when the particle appears to disappear. The asbestos fibers exhibit extinction when the particles are oriented in either the horizontal or vertical position; the soil amphibole particle shows extinction only in an inclined position. These pictures were taken with slightly crossed polarizing lenses.

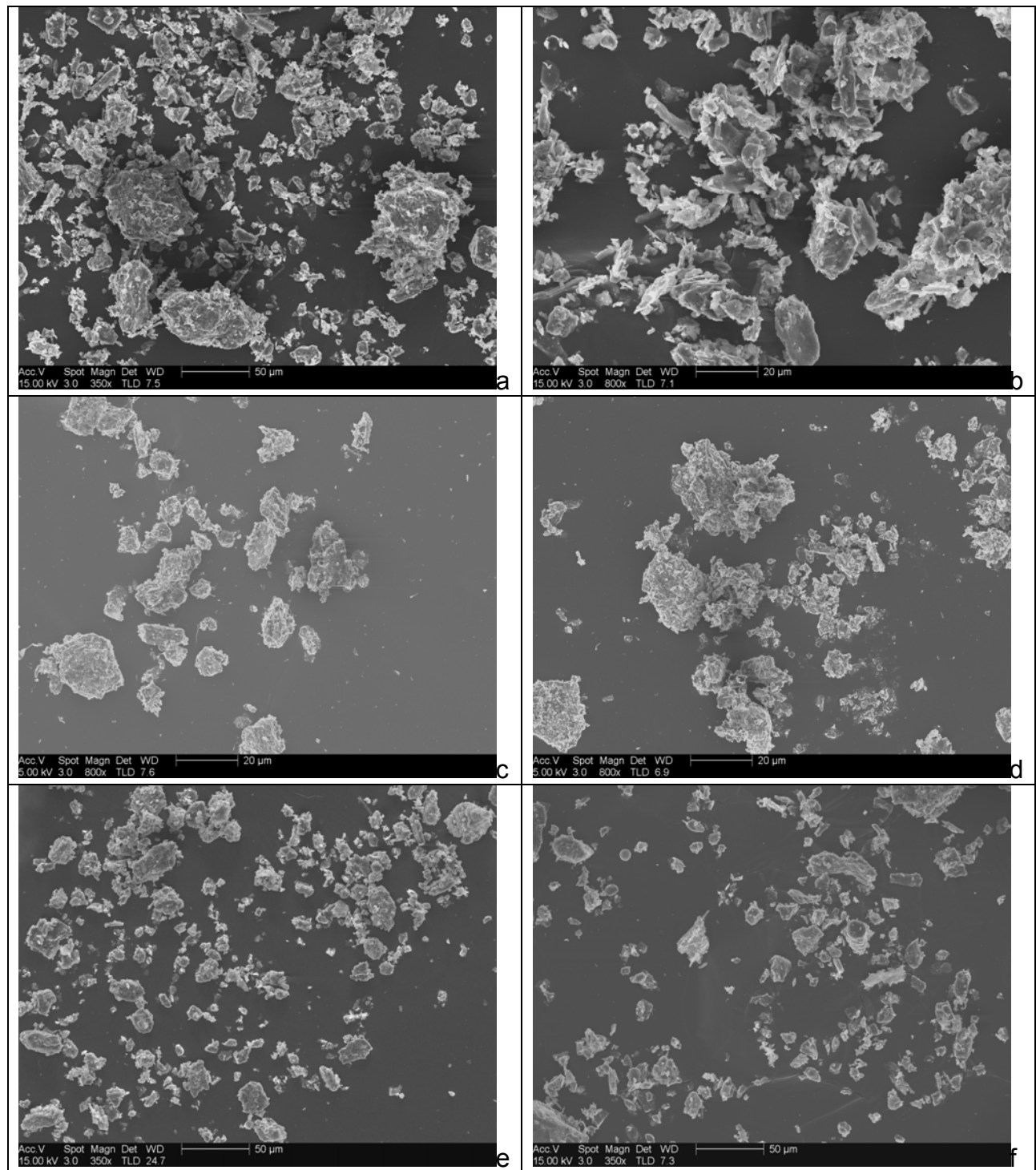


Figure 4-2. Illustrative micrographs of the soil particles found at El Dorado Hills. No fibrous particles are readily observed in these images. These samples are: a) NYT-SC3-100804-FG; b) NYT-SJ3-100804-FG; c) CPS-S05-100804-FG; d) SFB-S08-100804-FG; e) NFB-SS04-100804-FG; and f) JSS-S04-101004-FG2.

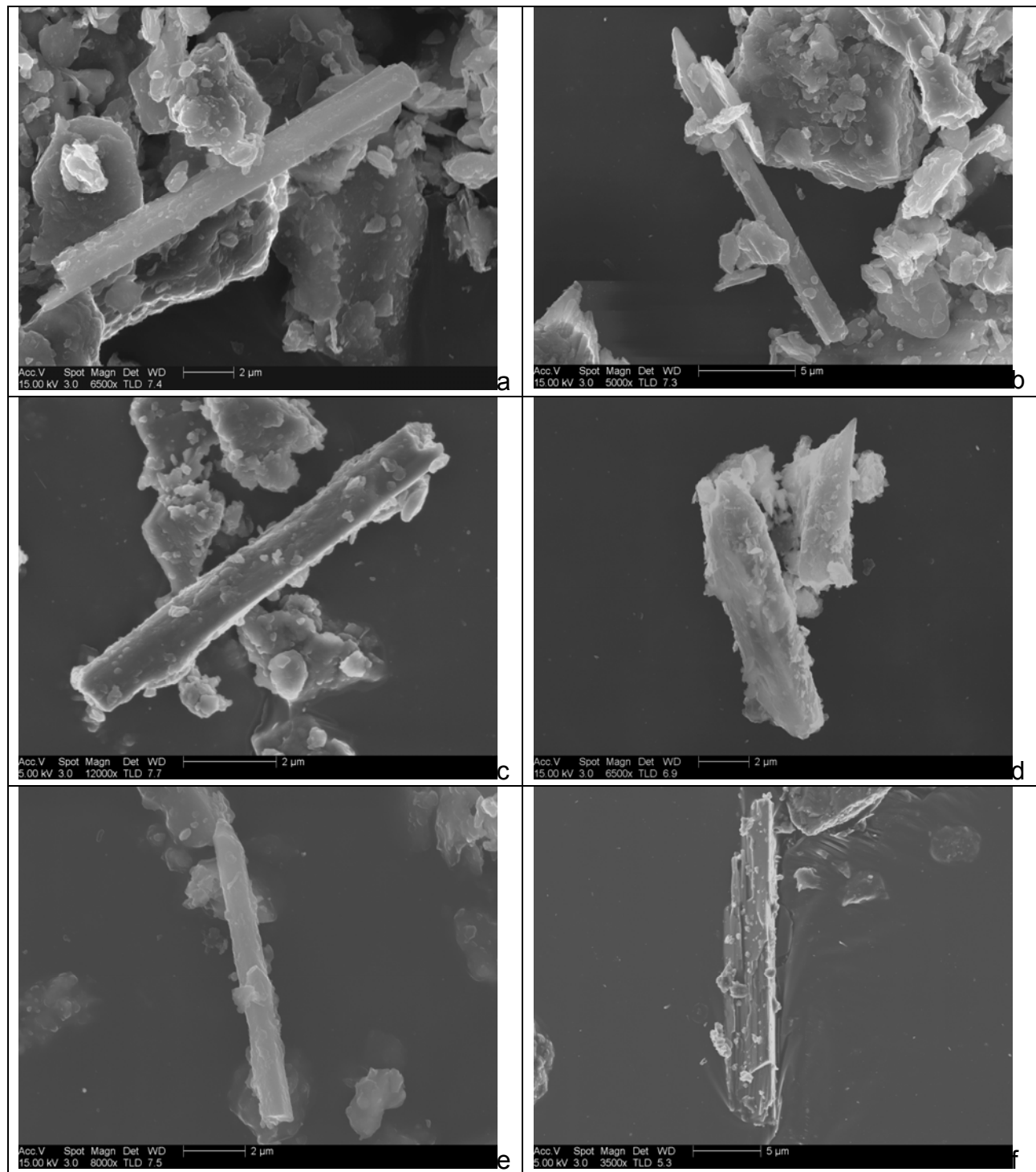


Figure 4-3. Illustrative micrographs of elongated mineral particles found at El Dorado Hills. No asbestos particles are observed in these images. These samples are: a) NYT-SC3-100804-FG; b) NYT-SJ3-100804-FG; c) CPS-S05-100804-FG; d) SFB-S08-100804-FG; e) NFB-SS04-100804-FG; and f) JSS-S04-101004-FG2.

Tables

Final

Table 2-1. Summary of the number of samples collected and analyzed during the El Dorado Hills project.

Report Table ³⁴	Activity	Sample Counts			Notes
		Analyzed	Pending*	QA	
5-1	Ambient Air Monitoring	18	3	0	AAMS-FB-100204 in produced data
5-2	Southern Reference Area	46	1	19	SRA-FB-1-00804 in produced data
5-3	Northern Reference Area	20	0	9	NRA-FB-101004 in produced data
5-4	New York Creek Perimeter	13	0	3	
5-6	Silva Valley Baseball Maintenance	15	1	4	
5-8	Silva Valley Baseball A	16	1	0	
5-9	Siva Valley Baseball B	20	0	0	
5-10	Rolling Hills Soccer	18	0	0	
5-11	Rolling Hills Basketball	20	0	4	RHB-L2-FB-100304 in produced data
5-14	Community Park Playground	13	2	0	TPG-L2-FB-100404 in produced data
5-15	Community Park North Baseball	15	10	2	
5-16	Community Park South Baseball A	16	10	2	SFBA-L2-FB-100504 in produced data
5-17	Community Park South Baseball B	18	9	2	SFBB-L2-FB-100604 in produced data
5-18	Community Park South Baseball C	14	9	3	
5-19	New York Creek Baseball	17	12	4	
5-20	Lower Soccer Field	23	3	10	
5-22	New York Creek Biking	15	0	0	
5-24	New York Creek Jogging A	11	0	0	
5-26	New York Creek Jogging B	13	0	2	
5-27	Jackson Elementary Garden	5	14	0	
5-28	Jackson Elementary Soccer	14	4	0	
5-29	Jackson Elementary Basketball	15	6	1	

* Pending – Samples not reported in the May 2005 EPA report.

³⁴ "Report Table" refers to the Tables in the May 2005 Ecology and Environment, Inc. report.

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Table 3-1. The number of chrysotile and amphibole particles (codes "F", "CF", and "MF") counted in the El Dorado Hills project

Activity	Chrysotile	Amphibole
Ambient Air Monitoring	29	54
Southern Reference Area	34	284
Northern Reference Area	22	72
New York Creek Perimeter	9	44
Silva Valley Baseball Maintenance	6	48
Silva Valley Baseball A	22	92
Siva Valley Baseball B	23	62
Rolling Hills Soccer	4	10
Rolling Hills Basketball	8	37
Community Park Playground	147	78
Community Park North Baseball	68	149
Community Park South Baseball A	449	125
Community Park South Baseball B	425	77
Community Park South Baseball C	285	150
New York Creek Baseball	23	29
Lower Soccer Field	23	128
New York Creek Biking	7	339
New York Creek Jogging A	3	272
New York Creek Jogging B	8	205
Jackson Elementary Garden	1	3
Jackson Elementary Soccer	2	37
Jackson Elementary Basketball	24	91
Total	1622	2386

Excludes Performance and Quality Assurance Samples

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Table 3-2. Summary of Reported Concentrations for Three Classifications of Mineral Particles.

	Mean	Median	Range
Primary, s/cc	0.021	0.0040	0 – 0.76
PCME, f/cc	0.0031	0.0010	0 – 0.07
Protocol, f/cc	0.0005	0	0 – 0.029
5-10	0.0002	0	0 – 0.014
≥ 10	0.0002	0	0 – 0.014

Table 3-3. Summary of the Number of Protocol Fibers Counted on the Air Samples from El Dorado Hills.

Samples		Amphibole		Chrysotile		Total
Type	Number	5 – 10 µm	≥ 10 µm	5 – 10 µm	≥ 10 µm	
Area	127	9	3	10	1	23
Personal	116	17	3	27	5	52
Reference	54	9	1	3	1	14

Dimensionally, Protocol Fibers are thinner than 0.5 µm

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Table 3-4. Comparison of the Average Protocol Fiber Concentrations (Chrysotile and Amphibole) for the Different Test Scenarios for the Reference Area, Personal Samples, and Area Samples.

Test	Date	Concentration, f/cc			p-values		
		Reference	Personal	Area	ANOVA	Kruskal-Wallis	Mann-Whitney
SVBA	10/2/04	0	0	0	—	—	—
SVM	10/2/04	0	0	0	—	—	—
RHB	10/3/04	0	0	0	—	—	—
RHS	10/3/04	0	0	0	—	—	—
SVBB	10/3/04	0	0	0	—	—	—
APG	10/4/04	0	0	—	—	—	—
TPG	10/4/04	0	0.00050	—	0.21	—	0.18
BIK	10/5/04	0	0	0	—	—	—
NFB	10/5/04	0	0.00032	0.00011	0.38	0.39	0.16
SFBA	10/5/04	0	0.00145	0	0.28	0.27	0.27
JOGA	10/6/04	0	0	0	—	—	—
SFBB	10/6/04	0	0.00054	0.00012	0.43	0.60	0.32
SFBC	10/6/04	0	0	0	—	—	—
CPS	10/7/04	0	0.00014	0.00009	0.75	0.72	0.45
JOGB	10/7/04	0	0.00014	0	0.52	0.49	0.45
NYB	10/7/04	0	0	0	—	—	—
TRA	10/9/04	0	—	0	—	—	—
JEB	10/10/04	0.00005	0	0	0.36	0.34	0.32
JEP	10/10/04	0.00005	0	0	0.39	0.37	0.32

ANOVA – analysis of variance comparing reference, personal, and area concentrations

Kruskal-Wallis – a nonparametric ANOVA for the three concentrations

Mann-Whitney – a nonparametric comparison of the reference and personal concentrations

Protocol Fibers – particles 10 µm and longer and thinner than 0.5 µm.

p-values – statistically significant findings are shown by p-values of 0.05 or less.

Final

Table 3-5. Comparison of the Average Amphibole Protocol Fiber Concentrations for the Different Test Scenarios for the Reference Area, Personal Samples, and Area Samples.

Test	Date	Amphibole Concentration, f/cc			p-values		
		Reference	Personal	Area	ANOVA	Kruskal-Wallis	Mann-Whitney
SVBA	10/2/04	0	0	0	—	—	—
SVM	10/2/04	0	0	0	—	—	—
RHB	10/3/04	0	0	0	—	—	—
RHS	10/3/04	0	0	0	—	—	—
SVBB	10/3/04	0	0	0	—	—	—
APG	10/4/04	0	0	—	—	—	—
TPG	10/4/04	0	0.00033	—	0.39	—	0.36
BIK	10/5/04	0	0	0	—	—	—
NFB	10/5/04	0	0.00032	0.00011	0.38	0.39	0.16
SFBA	10/5/04	0	0.00072	0	0.29	0.27	0.27
JOGA	10/6/04	0	0	0	—	—	—
SFBB	10/6/04	0	0	0	—	—	—
SFBC	10/6/04	0	0	0	—	—	—
CPS	10/7/04	0	0	0.0009	0.63	0.61	—
JOGB	10/7/04	0	0.00014	0	0.52	0.49	0.45
NYB	10/7/04	0	0	0	—	—	—
TRA	10/9/04	0	—	0	—	—	—
JEB	10/10/04	0.00005	0	0	0.36	0.34	0.32
JEP	10/10/04	0.00005	0	0	0.39	0.37	0.32

ANOVA – analysis of variance comparing reference, personal, and area concentrations

Kruskal-Wallis – a nonparametric ANOVA for the three concentrations

Mann-Whitney – a nonparametric comparison of the reference and personal concentrations

Protocol Fibers – particles 10 µm and longer and thinner than 0.5 µm.

p-values – statistically significant findings are shown by p-values of 0.05 or less.

Final

Table 3-6. Summary of Reported EDXA Spectra from Mineral Particles Identified as Actinolite. The values are reported as oxide compounds of the observed cations.

Compound	Mean	Median	Minimum	Maximum
Na ₂ O	0.16	0	0	3.12
MgO	14.72	14.23	8.36	24.01
Al ₂ O ₃	2.24	2.00	0	8.73
SiO ₂	56.65	56.53	43.55	63.99
K ₂ O	0.23	0.17	0	1.80
CaO	12.35	12.26	7.98	16.32
TiO ₂	0.05	0	0	0.79
CrO	0.02	0	0	0.55
MnO	0.10	0	0	1.10
Fe ₂ O ₃	13.47	14.03	4.34	23.69

Table 3-7. Average Dimensions of 2386 Amphibole Particles Counted During the Original Analyses of the Samples

Parameter	Mean	Median
Length, μm	6.8	5.3
Width, μm	1.1	0.8
Aspect Ratio	7.0	5.9

Table 3-8. Average Dimensions of 1323 Amphibole Particles Counted during the Original Analyses of the Samples that are 5 μm and longer (all widths).

Parameter	Mean	Median
Length, μm	9.8	8.0
Width, μm	1.6	1.4
Aspect Ratio	7.6	6.3

Final

Table 3-9. Average Dimensions of 85 Amphibole Bundles Counted During the Original Analyses of the Samples

Parameter	Mean	Median
Length, μm	8.5	7.0
Width, μm	1.8	0.8
Aspect Ratio	6.2	4.4

Table 3-10. Summary of the number of SAED Patterns reported by Lab/Cor, indicating the number of times the reported zone axis was the same as the zone axis that matched the SAED pattern. Also shown are the number of matched zones that were from a low order zone [0 or 1 X X] and from a high order zone axis [≥ 3 X X].

Mineral	Reported Zone = Matched Zone		Match Zone Distribution	
	Yes	No	Low [0, 1 X X]	High [≥ 3 X X]
Actinolite	136	167	25	214
Amosite	2	3	0	4
Anthophyllite	4	0	0	2
Edenite	1	5	1	4
Richterite	1	0	0	1
Tremolite	15	22	0	30
Winchite	2	1	0	2

Final

Table 3-11. Summary of the Quality Assurance analysis of same grid openings as were analyzed in the original analysis

Sample Number	True Count	Excess Counts	Original Over Count, %
CC2-H6-1CP-100504	8	5	62.5
CC2-L6-1CA-100504	9	14	155.6
CC6-H6-2CP-100704	2	0	0.0
CC6-L6-1CA1100704	5	1	20.0
CPS-H2-14FD-10074	2	1	50.0
CPS-H2-1PG-100704	3	2	66.7
CPS-H2-4FD-100704	4	3	75.0
JOGB-H2-5TR-100704	4	1	25.0
NRA-R03-101104	12	9	75.0
RHB-H2-2FD-100304	5	1	20.0
RHB-H2-3FD-100304	0	2	n/a
SFBC-H2-1FD-100604	16	16	100.0
SRA-R01-100204	10	3	30.0
SRA-R02-100604	0	10	n/a
SRA-R04-100104	9	4	44.4
SVM-H2-2FD-100204	3	0	0.0
Total	92	72	78.3

True Count – the number of fibers reported by both analysts.

Excess Counts – the number of particles counted in the Original analysis that were not confirmed by the second analysis.

Final

Table 3-12. Quality Assurance Testing on Three Samples: Three analyses of the same grid openings on each sample.

		SRA-R05- 100604	NRA-R02- 101104	CC2-H8-1CT- 100304	Totals
Original Analysis	True Positive	5	7	11	23
	False Negative	1	2	0	3
	False Positive	6	2	1	9
QA #1	True Positive	6	7	11	24
	False Negative	0	2	0	2
	False Positive	8	0	5	13
QA #2	True Positive	4	7	8	19
	False Negative	2	2	3	7
	False Positive	15	2	5	22

True Positives – the number of particles reported by two of the three analyses.

False Negative – any particle not reported by analyst "A" but reported by the other two analysts.

False Positive – any particle reported by analyst "A" but not by either of the other two analysts.

The total number of fibers that should have been reported is the sum of the True Positive and False Negative counts.

Final

Table 3-13. Listing of the "Blank" Filters Collected and Analyzed in This Study

Sample ID	Type	Volume, l
AAMS-1ZB-092904	Field Blank	4800
AAMS-1ZB-100204	Field Blank	4800
AAMS-2ZB-100204	Field Blank	4810
AAMS-FB-093004	Filter Blank	4800
AAMS-FB-100204	Filter Blank	0
SRA-1ZB-100804	Field Blank	6655.05
SRA-2ZB-100804	Field Blank	7221.6
SRA-FB-100804	Filter Blank	0
NRA-1ZB-101104	Field Blank	6753.24
NRA-2ZB-101104	Field Blank	6578
NRA-1ZB-101204	Field Blank	6753.24
NRA-FB-101004	Filter Blank	0
SVBA-L2-1ZB-100204	Field Blank	301.32
SVBB-L2-1ZB-100304	Field Blank	302.56
RHB-L2-1ZB-100304	Field Blank	326.4
RHB-L2-FB-100304	Filter Blank	0
APG-L2-1ZB-100404	Field Blank	299.76
TPG-L2-1ZB-100404	Field Blank	303.6
TPG-L2-FB-100404	Filter Blank	0
NFB-L2-1ZB-100504	Field Blank	301.29
SFBA-L2-1ZB-100504	Field Blank	306.22
SFBA-L2-FB-100504	Filter Blank	0
SFBB-L2-100604	Field Blank	308.75
SFBB-L2-FB-100604	Filter Blank	0
SFBC-L2-1ZB-100604	Field Blank	304.8
NYB-L2-1ZB-100704	Field Blank	302.05
CPS-H2-1ZB-100704	Field Blank	1201.29
CPS-L2-FB-100704	Filter Blank	0
JEG-L2-1ZB-101004	Field Blank	299.29
JEG-L2-FB-101004	Filter Blank	299.9
JEP-L2-1ZB-101004	Field Blank	301.87

Final

Table 3-14. Observed discrepancies between the summary report (see Figure 2-1) and the laboratory count sheets (see Figure 2-2).

Report Table	Sample #	Error
5-2	SRA-R04-100504	12 total structures counted, 11 reported
5-6	SVM-H2-5FD-100204	Grid A, No. 2, Loc. B12, reported as "NSD" (no structures detected), but also lists a 13 μm actinolite particle.
5-6	CC1-L6-1CB-100204	4 total structures reported, 5 counted
5-8	SVBA-L2-3CH-100204	9 total structures reported; 10 primary structures reported; 10 primary and 10 total structures counted
5-8	SVBA-L2-5CH-100204	13 total structures reported; 14 primary structures reported; 14 primary and 14 total structures counted
5-8	CC1-L6-1CB-100204	4 total structures reported; 5 primary structures reported; 5 primary and 5 total structures counted
5-9, 5-10, 5-11	CC2-L6-11CC-100304	2 total structures reported; 3 primary structures reported; 3 primary and 3 total structures counted
5-9, 5-10, 5-11	CC2-L6-4CC-100304	Grid B, No. 29, Loc. B22 reported as "NSD" (no structures detected), but also lists a 4.2 μm actinolite particle. True total particle count is 14, not 15.
5-9, 5-10, 5-11	CC2-L6-4CC-100304	Grid B, No. 29 is listed as Loc. B22 and as Loc. B2.
5-15, 5-16	CC2-L6-1CA-100504	25 total structures reported; 26 total structures counted
5-16	SFBA-L2-4CH-100504	49 total structures reported; 50 primary structures reported; 50 primary and 50 total structures counted
5-16	SFBA-L2-1ZB-100504	Data analyzed 1/16/2004, date collected 10/5/2004
5-17	SFBB-H2-11PG-100604	27 total structures reported; 28 primary structures reported; 28 primary and 28 total structures counted
5-17	SFBB-L2-4CH-100604	50 total structures reported; 51 primary structures reported; 51 primary and 51 total structures counted
5-18	SFBC-H2-1FD-100604	22 grid openings reported as counted, 23 actually counted
5-18	SFBC-H2-3PG-100604	21 grid openings reported as counted, 22 actually counted
5-18	SFBC-L2-2CH-100604	103 total structures reported; 102 total structures counted
5-19	NYB-L2-2CH-100704	35 total structures reported; 33 primary structures reported; 33 primary and 36 total structures counted

Final

Report Table	Sample #	Error
5-19	NYB-L2-2CH-100704	89 grid openings reported as counted, 90 actually counted
5-19	NYB-L2-2CH-100704	PCME concentration incorrectly reported as 0.04. Lab/Cor reported 4 PCME structures. With an analytical sensitivity of 0.00101, the PCME concentration is $4 \times 0.00101 = 0.004$ f/cc. This error was carried through to the May report.
5-20	CPS-L2-1CH-100704	90 grid openings reported as counted, 91 actually counted
5-22	BIK-L2-5CH-100504	88 grid openings reported as counted, 89 actually counted

Final

Table 4-1. Soil Samples Received on August 26 from Youngdahl Consulting Group. The samples were split samples collected by Ecology & Environment during the September – October 2004 sampling in El Dorado Hills, CA.

Location	Field Sample No.	TEM Asbestos ^a Sample #	TEM Asbestos Reported Concentrations	Analyses Performed by RJLG
Unknown	EDH-ZP3-100704			PLM, SEM, TEM
New York Creek Trail	NYT-SC3-100804-FG2	741-00023-034	1 – 5% Actinolite	PLM, SEM
New York Creek Trail	NYT-SJ3-100804-FG2	741-00024-046	1 – 5% Actinolite	PLM, SEM, XRD, TEM
New York Creek Trail	NYT-SH2-100804-FG2	741-00024-049	1 – 5% Actinolite	PLM
New York Creek Trail	NYT-SF1-100804-FG2	741-00023-026	< 1% Actinolite	PLM, SEM, XRD
New York Creek Trail	NYT-SA1-100804-FG2	741-00023-040	1 – 5% Actinolite	PLM, SEM, XRD
Community Park Soccer Field	CPS-S05-100804-FG2	741-00023-018	< 1% Actinolite	PLM, SEM, XRD, TEM
Community Park Soccer Field	CPS-S101-100804-FG2	741-00023-015	< 1% Actinolite	PLM, SEM, TEM
New York Creek Baseball Field	NYB-S08-100804-FG2	741-00023-008	< 1% Actinolite	PLM
New York Creek Baseball Field	NYB-S09-100804-FG2	741-00023-007	1 – 5% Actinolite	PLM
Community Park South Field	SFB-S08-100804-FG2	741-00024-026	< 1% Actinolite	PLM, SEM
Community Park South Field	SFB-S09-100804-FG2	741-00024-032	< 1% Actinolite	PLM
Community Park North Field	NFB-SS02-100804-FG2	741-00024-015	< 1% Actinolite	PLM
Community Park North Field	NFB-SS04-100804-FG2	741-00024-013	< 1% Actinolite	PLM, SEM, XRD
Community Park North Field	NFB-S04-100804-FG2	741-00023-051	1 – 5% Actinolite	PLM, SEM, TEM
Silva Valley Baseball Field	SVB-S06-100904-FG2	741-00025-029	< 1% Actinolite	PLM
Silva Valley Baseball Field	SVB-S08-100904-FG2	741-00025-012	< 1% Actinolite	PLM
Jackson Elementary Field	JSS-S04-101004-FG2	741-00026-015	< 1% Actinolite	PLM, SEM, XRD
Jackson Elementary Field	JSS-S07-101004-FG2	741-00026-018	< 1% Actinolite	PLM, SEM
Rolling Hills Soccer Field	RHS-S02-100904-FG2	741-00025-032	< 1% Actinolite	PLM, SEM
Rolling Hills Soccer Field	RHS-S07-100904-FG2	741-00025-031	< 1% Actinolite	PLM
Jackson Elementary School Garden	JSG-S09-101004-FG2	741-00026-003	< 1% Actinolite	PLM
Dirt Embankment	DEM-S03-100904-FG2	741-00025-001	< 1% Actinolite	PLM, SEM, TEM

a – TEM Asbestos Laboratories, Inc.

PLM – polarized light microscopy; XRD – X-ray powder diffraction; SEM – scanning electron microscopy; TEM – transmission electron microscopy

A. Appendix 1

The data from the Original and Quality Assurance (QA) Analyses are presented in these pages. The data from the QA analysis have been rearranged to correspond with the Original analysis. The primary counts from the original analyses that were not verified are highlighted in orange.

Final
SRA-R04-100104

Count	Original Analysis									QA Analysis							
	Gr	No	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
1	A	1	A12	AZQ	1	1	F	3.8	0.3	13	AQ	6	6	F	3.8	0.38	10
	A	2	B22	AQ	2	2	F	3.5	1	3.5		NSD					
2	A	3	B10	AQ	3	3	F	7.5	1	7.5	AQ	1	1	F	7.5	1	7.5
3	A	3	B10	AQ	4		MD1-0	4	1.8	2.2	AQ	2		MD1-0	4.3	1.5	2.9
	A	3	B10	AQ		4	MF	4	0.45	8.9	AQ		2	MF	3.5	0.22	16
4	A	3	B10	AQ	5	5	F	4.5	1.2	3.7	AQ	3	3	F	4	1	4
	A	4	A30		NSD							NSD					
	A	5	D2	AQ	6	6	F	7.5	1.8	4.2							
	A	5	D2								AQ	7	7	F	2	0.6	3.3
5	A	6	D31	AQ	7	7	F	2.5	0.7	3.6	AQ	9	9	F	2.5	0.4	6.2
6	A	7	D23	AQ	8	8	F	4	1.1	3.6	AQ	8	8	F	3	0.25	12
	A	7	D23														
7	A	8	C10	AQ	9		MD1-1	7.5	4	1.9	AQ	4		MD1-1	7.8	3.8	2.1
	A	8	C10	AQ		9	MF	7.5	0.7	11	AQ		4	MF	6.5	0.7	9.3
	A	8	C10	AQ	10	10	F	2.4	0.6	4							
	A	9	C41	AQ	11	11	F	5	1	5	AQ	5	5	F	4.5	1	4.5
	A	10	C22		NSD							NSD					
	A	11	C14		NSD							NSD					
	B	12	A30		NSD							NSD					
	B	13	A11		NSD							NSD					
	B	14	D21		NSD						AQ	11	11	F	5.8	1	5.8
9	B	15	C40	AQ	12	12	F	3.7	0.5	7.4	AD	10	10	F	3.8	0.45	8.4
	B	16	C11		NSD							NSD					
	B	17	C24	AQ	13	13	F	9	0.8	11		NSD					
	B	18	B1		NSD							NSD					
	B	19	B20		NSD							Not Analyzed					

Final
SRA-R01-100204

Count	Original Analysis										QA Analysis						
	Gr	No	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
	A	1	B22		NSD												
	A	2	C2	ADQ	1	1	F	12	1.4	8.6							
	A	2	C2								AQ	4	4	F	11.5	1.2	9.6
1	A	3	C32	AZQ	2	2	F	1.9	0.6	3.2	AQ	5	5	F	1.8	0.6	3
2	A	4	A41	CD	3		MD1-0	2	0.4	5	CDQ	2		MD1-0	1.7	0.35	4.9
	A	4	A41	CD		3	MF	0.8	0.1	8	CDQ		2	MF	0.8	0.11	7.3
3	A	4	A41	ADQ	4	4	F	3	0.22	14	AQ	3	3	F	2	0.18	11
4	A	5	A21	AZQ	5		MD1-1	16	10	1.6	ADQ	1		MD1-1	30	15	2
	A	5	A21	AZQ		5	MF	8	1.2	6.7	ADQ		1	MF	7.8	1	7.8
5	A	6	D11	ADQ	6	6	F	2.8	0.4	7	AQ	6	6	F	2.6	0.45	5.8
	A	7	D41								CD	7		MD1-0	7.5	3	2.5
	A	7	D41								CD		7	MF	1.2	0.11	11
	A	7	D41	CDQ	7		MD1-0	4	1.2	3.3	CD						
	A	7	D41	CDQ		7	MF	1.2	0.08	15	CD						
	B	8	B34		NSD							NSD					
	B	9	B14		NSD						CD	8		MD3-0	2	1	2
	B	9	B14								CD		8	MF	1.2	0.11	11
	B	9	B14								CD		9	MF	1.2	0.1	12
	B	9	B14								CD		10	MF	1	0.1	10
	B	10	C4	CMQ	8		MD3-0	2	1	2		Not Analyzed					
	B	10	C4	CMQ		8	MF	1.2	0.1	12							
	B	10	C4	CMQ		9	MF	1	0.1	10							
	B	10	C4	CMQ		10	MF	0.8	0.1	8							
	B	11	C24		NSD							NSD					
6	B	12	D1	AQ	9	11	F	3	0.5	6	AQ	9	11	F	3	0.5	6
7	B	13	D21	AQ	10		MD1-0	4.5	3.5	1.3	AQ	10		MD1-0	4.5	3.8	1.2
	B	13	D21	AQ		12	MF	1.3	0.35	3.7	AQ		12	MF	1.3	0.35	3.7
8	B	13	D21	AQ	11		MD1-0	13	6	2.2	AQ	11		MD1-0	12	6	2
	B	13	D21	AQ		13	MF	3	0.2	15	AQ		13	MF	4	0.18	22
9	B	13	D21	AQ	12	14	F	3.5	0.38	9.2	AQ	12	14	F	3.8	0.38	10
10	B	14	D41	AQ	13	15	F	2	0.4	5	AQ	13	15	F	2	0.38	5.3

Final
SRA-R02-100604

Count	Original Analysis										QA Analysis						
	Gr	No	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
	A	1	B41		NSD							NSD					
	A	2	B21	AQ	1		MD1-1	15	10	1.5							
	A	2	B21	AQ		1	MF	9	0.65	14							
	A	2	B21								AQ	1	1	F	6	0.9	6.7
	A	2	B21								AQ	2	2	F	9	0.7	13
	A	3	B1	AQ	2		MD1-1	7.5	5	1.5							
	A	3	B1	AQ		2	MF	7	0.85	8.2							
	A	3	B1								AQ	3	3	F	2	0.5	4
	A	4	C11	AQ	3		MD1-0	6	6	1		NSD					
	A	4	C11	AQ		3	MF	4	1	4							
	A	5	C31	AQ	4		MD1-0	5	4	1.2		NSD					
	A	5	C31	AQ		4	MF	4.5	0.75	6							
	A	6	C42		NSD						AQ	4	4	F	6	1.1	5.5
	A	6	C42								AQ	5		MD1-1	12	10	1.2
	A	6	C42								AQ		5	MF	5.2	1	5.2
	A	7	C33	AQ	5	5	F	5	0.75	6.7							
	A	7	C33	AQ	6		MD1-0	20	15	1.3							
	A	7	C33	AQ		6	MF	4	0.85	4.7							
	A	7	C33	AQ	7		MD2-0	35	15	2.3							
	A	7	C33	AQ		7	MF	4	0.75	5.3							
	A	7	C33	AQ		8	MF	4	0.65	6.2							
	A	7	C33	AQ	8		MD1-0	10	7.5	1.3							
	A	7	C33	AQ		9	MF	5	1	5							
	A	7	C33								AQ	6	6	F	4.9	0.7	7
	A	7	C33								AQ	7	7	F	10	3	3.3
	A	7	C33								AQ	8	8	F	11	0.9	12
	A	7	C33								AQ	9	9	F	4	0.8	5
	A	7	C33								AQ	10	10	F	5	0.8	6.2
	A	7	C33								AQ	11	11	F	11	1.1	10
	B	8	D41		NSD							NSD					
	B	9	D21	AQ	9		MD1-1	15	14	1.1							
	B	9	D21	AQ		10	MF	10	2.75	3.6							
	B	9	D21								AQ	12	12	F	9	2.3	3.9
	B	9	D21								AQ	13	13	F	2.3	0.4	5.8
	B	10	D1		NSD							NSD					
	B	11	A11		NSD							NSD					
	B	12	A31		NSD							NSD					
	B	13	A40	AZQ	10		MD1-1	11	8	1.4							
	B	13	A40	AZQ		11	MF	5.5	0.75	7.3							
	B	13	A40								AQ	14	14	F	9.5	2.5	3.8
	B	13	A40								AQ	15	15	F	6	0.9	6.7
	B	14	A20		NSD							NSD					

Final
SRA-R05-100604

Count	Original Analysis									QA Analysis #1						QA Analysis #2								
	Gr	No	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
	A	1	A2		NSD						NSD							AQ	1		MD1-1	20	15	1.3
	A	1	A2															AQ		1	MF	5.5	0.55	10
1	A	2	A20		NSD						AQ	1	1	F	12	2	6	AQ	2	2	F	12	2	6
2	A	3	B11	AZQ	1	1	B	13	0.7	19	AQ	2	2	B	12.5	1	12							
	A	3	B11								AQ	3	3	F	13	2.5	5							
	A	3	B11								AQ	4		MD1-1	12	10	1							
	A	3	B11								AQ		4	MF	12	1.5	8							
	A	3	B11															AQ	3		MD2-2	15	15	1
	A	3	B11															AQ		3	MF	15	1.2	12
	A	3	B11															AQ		4	MF	13	2.5	5.2
	A	3	B11															AQ	4		MD1-1	7.5	6	1.2
	A	3	B11															AQ		5	MF	6	0.75	8
	A	3	B11															AQ	5	6	F	1.5	0.25	6
	A	3	B11															AQ	6		MD1-1	20	12	1.7
	A	3	B11															AQ		7	MF	12	2.5	4.8
	A	3	B11															AQ	7		MD1-0	2.5	2	1.2
	A	3	B11															AQ		8	MF	2.5	0.2	12
3	A	4	B23	AQ	2	2	F	12	1	12	AQ	5	5	F	12	0.9	13							
	A	4	B23															AD	8		MD1-0	10	7.5	1.3
	A	4	B23															AD		9	MF	5	1	5
	A	4	B23															AD	9		MD1-1	17	10	1.7
	A	4	B23															AD		10	MF	12	1	12
	A	5	C12	AQ	3	3	F	1.7	0.5	3.4														
4	A	5	C12	AQ	4	4	F	7	0.5	14	AQ	6	6	F	7	0.5	14	AQ	10	11	F	6	0.3	20
	A	6	C31		NSD						AQ	7		MD	15	15	1	NSD						
	A	6	C31								AQ		7	MF	8	0.5	16							
5	A	7	D21	AQ	5	5	F	8	1.2	6.7	AQ	8	8	F	8.3	1.1	8	AQ	11	12	F	7.5	1.2	6.2
	B	8	D2		NSD						NSD							AQ	12	13	F	30	5	6
	B	9	A11	AQ	6		MD2-1	25	22	1.1														
	B	9	A11	AQ		6	MF	22	0.7	31														
	B	9	A11	AQ		7	MF	4.8	0.3	16														
	B	9	A11								AQ	9	9	F	3	0.3	10							
	B	9	A11								AQ	10		MD1-1	20	10	2							
	B	9	A11								AQ		10	MF	15	0.8	19							
	B	9	A11															AQ	13		MD1-0	25	25	1
	B	9	A11															AQ		14	MF	4	0.6	6.7
	B	10	A30		NSD						NSD							AQ	14	15	F	2.5	0.25	10
	B	11	B23	AQ	7	8	B	3	0.8	3.8	NSD													
	B	11	B23															AQ	15		MD1-0	5	3	1.7
	B	11	B23															AQ		16	MF	2.85	0.75	3.8
	B	12	C1		NSD						NSD							NSD						
	B	13	C32	AQ	8	9	F	2.5	0.3	8.3														
	B	13	C32	AQ	9	10	F	4.9	0.7	7														
	B	13	C32								AQ	11		MD1-1	11	4	3							
	B	13	C32								AQ		11	MF	11	1	11							
	B	13	C32															AQ	16		MD2-0	7.5	7.5	1
	B	13	C32															AQ		17	MF	5	1.1	4.5
	B	13	C32															AQ		18	MF	2.5	0.6	4.2
	B	14	D40		NSD						AQ	12	12	F	5.1	0.4	13							
	B	14	D40								AQ	13	13	F	9	1.5	6							
	B	14	D40															AQ	17		MD1-0	5	5	1
	B	14	D40															AQ		19	MF	4.5	0.35	13
	B	14	D40															AQ	18		MD1-1	7.5	7.5	1
	B	14	D40															AQ		20	MF	7.5	1.5	5
6	B	15	D11	AQ	10	11	B	11	1.3	8.5	AQ	14	14	B	11	1.3	9	AQ	19	21	F	11	1.2	9.2
	B	15	D11	AQ	11	12	F	5.3	1	5.3														

Final

NRA-R02-101104

Count	Original Analysis										QA Analysis #1						QA Analysis #2								
	Gr	No.	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp	
	A	1	A22		NSD														NSD						
	A	2	A40		NSD														NSD						
	A	3	B21	AQ	1		MD1-1	35	10	3.5															
	A	3	B21	AQ		1	MF	35	2.2	16															
1	A	3	B21								AQ	1	1	F	23	1.8	13	ADQ	1	1	F	29	1.5	19	
	A	4	B3		NSD														NSD						
2	A	5	C14	AQ	2	2	F	2.6	0.6	4.3	AQ	2	2	F	4	0.6	6.7		NSD						
	A	6	C32		NSD														NSD						
	A	7	C40	AQ	3		MD1-1	10	8	1.2															
	A	7	C40	AQ		3	MF	7.5	0.8	9.4															
3	A	7	C40	AQ	4		MD1-0	4	2	2.0									AQ	3		MD1-0	4	2.5	1.6
	A	7	C40	AQ		4	MF	4	0.2	20									AQ		3	MF	4	0.25	16
4	A	7	C40								AQ	3	3	F	7.5	0.8	9.4	AQ	2	2	F	7.5	0.7	11	
	A	8	D31		NSD														NSD						
	A	9	D11		NSD														NSD						
	B	10	A22		NSD														NSD						
5	B	11	A3	AQ	5	5	F	13	2	6.5	AQ	4	4	F	13	2	6.5	AQ	4	4	F	12.8	2	6.4	
	B	12	D22		NSD														NSD						
6	B	13	D30	AQ	6	6	F	5.2	1.4	3.7	AQ	5	5	F	5.2	1.6	3.2								
7	B	13	D30	AQ	7	7	F	4	0.3	13									AD	5	5	F	4	0.4	10
	B	14	C32		NSD														NSD						
8	B	15	C11	AQ	8	8	F	8	1.3	6.2	AQ	6	6	F	8	1.5	5.3	AQ	6	6	F	8	1.3	6.2	
9	B	16	B1	AQ	9		MD1-1	18	15	1.2	AQ	7		MD1-1	17	15	1.1	AD	7		MD1-0	15	13	1.2	
	B	16	B1	AQ		9	MF	7	0.5	14	AQ		7	MF	8	0.5	16	AD		7	MF	4	0.5	8.0	
	B	17	B22		NSD														AD	8		MD1-0	5	3.8	1.3
	B	17	B22																AD		8	MF	3	0.8	3.8
	B	17	B22																AQ	9		MD1-1	18	8	2.2
	B	17	B22																AQ		9	MF	12	3.3	3.6

Final

NRA-R03-101104

Count	Original Analysis										QA Analysis							
	Gr	No.	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp	
1	A	1	B31	ADQ	1	1	F	14	2.2	6.4	AQ	1	1	F	16	2	8.0	
	A	2	B11								AQ	2	2	F	4.9	0.9	5.4	
	A	2	B11	AQ	2		MD1-0	15	8	1.9								
	A	2	B11	AQ		2	MF	4.5	0.7	6.4								
	A	2	B11	AZQ	3		MD1-0	15	7	2.1								
	A	2	B11	AZQ		3	MF	4.6	0.7	6.6								
	A	2	B11								AQ	3		MD1-1	18	15	1.2	
	A	2	B11								AQ		3	MF	10	1.4	7.1	
	A	3	C11								AQ	4	4	F	9	2.5	3.6	
2	A	3	C11	CDQ	4	4	B	1.8	0.22	8.2	CD	5	5	B	1.7	0.3	5.7	
3	A	3	C11	CD	5		CD3-0	2.2	0.8	2.8	CD	6		CD3-0	2.5	0.8	3.1	
	A	3	C11	CD		5	CF	1.1	0.08	14	CD		6	CF	1.2	0.01	120	
	A	3	C11	CD		6	CF	1.1	0.1	11	CD		7	CF	1.5	0.05	30	
	A	3	C11	CD		7	CF	0.6	0.1	6.0	CD		8	CF	1	0.1	10	
	A	4	D1	CD	6	8	B	5	0.6	8.3								
	4	A	4	D1	AQ	7	9	F	10.6	1.1	9.6	AQ	7	9	F	11	1.2	9.2
	5	A	4	D1	AQ	8	10	F	8	1.2	6.7	AQ	8	10	F	9	1.8	5.0
	6	A	4	D1	ADQ	9	11	F	2.1	0.4	5.2	AQ	9	11	F	2.5	0.5	5.0
A		5	D31		NSD						NSD							
A		6	B33		NSD						AQ	10	12	B	4.9	2.5	2.0	
A		7	B13	CD	10		MD1-0	3.8	2.5	1.5		NSD						
A		7	B13	CD		12	MF	1.5	0.08	19								
A		8	C23								AQ	11	13	F	13	3	4.3	
A		8	C23	AQ	11	13	F	3.3	0.5	6.6								
7		A	8	C23	AQ	12	14	F	5	0.7	7.1	AQ	12	14	F	4	0.8	5.0
		B	9	B42								AQ	13	15	F	5.2	0.7	7.4
8		B	9	B42	AQ	13		MD1-1	12	8	1.5	AQ	14		MD1-1	8	8	1.0
	B	9	B42	AQ		15	MF	5.2	0.6	8.7	AQ		16	MF	8	0.7	11	
	B	10	B22								AQ	19	23	F	8	2.2	3.6	
	B	10	B22	AQ	14		MD1-0	8	8	1.0								
	B	10	B22	AQ		16	MF	1.2	0.35	3.4								
	B	10	B22								AQ	20		MD1-1	8	7	1.1	
	B	10	B22								AQ		24	MF	8	0.6	13	
9	B	10	B22	CDQ	15	17	F	1.5	0.1	15	CD	21	25	F	1.6	0.05	32	
	B	11	B2		NSD						NSD							
	B	12	C12		NSD						NSD							
	B	13	A41	AQ	16	18	F	1.7	0.5	3.4								
10	B	13	A41	CD	17	19	F	1.2	0.05	24	CM	16	18	F	1.5	0.04	38	
	B	13	A41								AQ	15	17	F	13	2.5	5.2	
	B	14	A21		NSD						NSD							
	B	15	A1	CD	18	20	B	0.9	0.15	6.0		NSD						
11	B	16	D20	CMQ	19	21	B	24	4	6.0	CD	17	19	B	28	3	9.3	
12	B	16	D20	CDQ	20		MD3-0	6.8	4	1.7	CD	18		MD3-0	8	4	2.0	
	B	16	D20	CDQ		22	MB	1.5	0.3	5.0	CD		20	MB	2.5	0.06	42	
	B	16	D20	CDQ		23	MF	0.6	0.08	7.5	CD		21	MF	0.6	0.06	10	
	B	16	D20	CDQ		24	MF	0.5	0.08	6.2	CD		22	MF	0.5	0.06	8.3	
	B	16	D20	CDQ	21	25	B	4	1	4.0								

Final

CC2-H8-1CT-100304

Count	Original Analysis									QA Analysis #1						QA Analysis #2									
	Gr	No	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp	
1	A	1	B44	AZQ	1		MD1-1	17	7.75	2.2	AZQ	1		MD1-1	17.5	8	2.2	AQ	4		MD1-1	17.5	7	2.5	
	A	1	B44	AZQ		1	MB	15.5	3.75	4.1	AZQ		1	MB	16	3.9	4.1	AQ		4	MF	15	4.3	3.5	
	A	2	B24		NSD							NSD							NSD						
2	A	3	B4	CDQ	2	2	F	0.7	0.1	7	CMQ	2	2	F	0.6	0.1	6	CD	3	3	F	0.6	0.08	7.5	
3	A	3	B4	CMQ	3		MD1-0	6	4	1.5	CMQ	3		MD1-0	6	4.25	1.4								
	A	3	B4	CMQ		3	MF	4.5	0.1	45	CMQ		3	MF	4	0.1	40								
	A	3	B4														40	CD	2		MD1-0	6	4	1.5	
	A	3	B4														40	CD		2	MB	1.5	0.1	15	
4	A	4	C14	AQ	4	4	F	13.3	1.75	7.6	AQ	7	7	F	13.5	2	6.8	AQ	5	5	F	14	1.5	9.3	
	A	5	C34	CMQ	5	5	F	0.7	0.05	14															
5	A	5	C34	AQ	6	6	F	2	0.25	8	AQ	4	4	F	2.1	0.25	8.4	AQ	6	6	F	2	0.38	5.3	
	A	6	C43		NSD						AQ	5	5	F	1.2	0.2	6		NSD						
	A	6	C43								AQ	6		MD1-1	9.5	3.3	2.9								
	A	6	C43								AQ		6	MF	8.5	1.6	5.3								
	A	7	C23		NSD							NSD							NSD						
6	A	8	B13	AQ	7	7	F	11.5	0.8	14	AQ	8	8	F	10.2	1	10	AQ	1	1	F	10.8	0.8	13	
	B	9	B34		NSD							NSD							NSD						
7	B	10	B14	AQ	8		MD1-1	30.5	5.5	5.5	AQ	9		MD1-1	31	14	2.2	AQ	7		MD1-1	27	5	5.4	
	B	10	B14	AQ		8	MF	26	1.5	17	AQ		9	MF	26	1.15	23	AQ		7	MF	24	1.3	18	
	B	11	C4		NSD							NSD							NSD						
	B	12	C24								AZQ	10		MD1-1	13.8	9	1.5								
	B	12	C24								AZQ		10	MF	13.8	3	4.6								
8	B	12	C24	AQ	9	9	F	4.25	1.1	3.9	AQ	11	11	F	4.25	1.2	3.5								
	B	12	C24															AQ	8	8	F	14	3	4.7	
	B	13	C44		NSD							NSD						AQ	9		MD1-0	11	8	1.4	
	B	13	C44															AQ		9	MF	4.5	1	4.5	
	C	14	B44	AQ	10	10	F	6	1.75	3.4	AQ	12	12	F	6.2	1.75	3.5	AQ	10	10	F	6.5	2	3.2	
9	C	14	B44															AQ	11	11	F	10	3	3.3	
	C	15	B24		NSD							NSD							NSD						
	C	16	B4		NSD							NSD							NSD						
	C	17	C14		NSD							AQ	13		MD1-1	22	18	1.2		NSD					
	C	17	C14									AQ		13	MF	10.3	1.75	5.9							
	C	18	C44									AQ	14		MD1-1	45	8	5.6							
	C	18	C44									AQ		14	MF	45	2.5	18							
	C	18	C44	AQ	11	11	F	3.45	0.3	12	AQ	15	15	F	3.4	0.25	14	AQ	13	13	F	3.8	0.3	13	
11	C	18	C44	AQ	12		MD1-0	10.5	8	1.3	AQ	16		MD1-0	10.25	8.5	1.2								
	C	18	C44	AQ		12	MF	4	0.4	10	AQ		16	MF	3.5	0.45	7.8								
	C	18	C44															AQ	12	12	F	40	2.5	16	

Final
SVM-H2-2FD-100204

Count	Original Analysis										QA Analysis						
	Gr	No	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
	A	1	B34		NSD							NSD					
	A	2	B24		NSD							NSD					
	A	3	B14		NSD							NSD					
	A	4	C4		NSD							NSD					
	A	5	C14		NSD							NSD					
	A	6	C34		NSD							NSD					
	A	7	C43		NSD							NSD					
	A	8	C33		NSD							NSD					
	A	9	C13		NSD							NSD					
	A	10	C3		NSD							NSD					
	A	11	B13		NSD							NSD					
	A	12	B23		NSD							NSD					
	A	13	A41		NSD							NSD					
	A	14	A21		NSD							NSD					
	B	15	B44		NSD							NSD					
	B	16	B34		NSD							NSD					
	B	17	B24		NSD							NSD					
	B	18	C4		NSD							NSD					
	B	19	C14		NSD							NSD					
	B	20	C24		NSD							NSD					
1	B	21	C34	CDQ	1	1	B	10	2	5	CDQ	1	1	B	16	1	16
	B	22	C44		NSD							Not Analyzed					
2	B	23	C23	AZQ	2	2	F	10	2	5	AQ	2	2	F	10	1.8	5.6
3	B	23	C23	AQ	3	3	F	5	0.85	5.9	AQ	3	3	F	4.3	0.9	4.8

Final
RHB-H2-2FD-100304

Count	Original Analysis										QA Analysis						
	Gr	No.	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
	A	1	A43		NSD							NSD					
	A	2	A23		NSD							NSD					
	A	3	A3		NSD							NSD					
	A	4	D13		NSD							NSD					
1	A	5	D33	AZQ	1	1	F	4.9	0.7	7	AQ	1	1	F	4.7	0.6	7.8
	A	6	D41		NSD							NSD					
	A	7	D21	AQ	2		MD1-0	4.3	2.7	1.6							
	A	7	D21	AQ		2	MF	4	0.45	8.9							
	A	7	D21								AQ	2	2	F	4	0.5	8
	A	8	D1		NSD							NSD					
	A	9	A11		NSD							NSD					
	A	10	B40		NSD							NSD					
	A	11	B20		NSD							NSD					
	A	12	C1		NSD							NSD					
2	B	13	B43	AQ	3	3	F	4.8	1.2	4	AQ	3	3	F	4	1.3	3.1
	B	14	B23		NSD							NSD					
	B	15	B3		NSD							NSD					
	B	16	C13		NSD							NSD					
	B	17	C43		NSD							NSD					
3	B	18	C41	AQ	4	4	F	11	1	11	AQ	4	4	F	11	0.9	12
	B	19	C21		NSD							NSD					
	B	20	C1		NSD							NSD					
	B	21	B11		NSD							NSD					
4	B	22	B31	AQ	5	5	F	7.7	0.5	15	AQ	5	5	F	8	0.5	16
5	B	22	B31	AQ	6	6	F	6	1.5	4	AQ	6	6	F	6	1.2	5

Final
RHB-H2-3FD-100304

Count	Original Analysis										QA Analysis						
	Gr	No.	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
	A	1	B42		NSD							NSD					
	A	2	B12		NSD							NSD					
	A	3	C12		NSD							NSD					
	A	4	B14		NSD							NSD					
	A	5	C14		NSD							NSD					
	A	6	C44		NSD						ADQ	2	2	F	11	0.9	12
	A	7	A20		NSD						AQ	1	1	F	6	1.5	4
	A	8	D10		NSD							NSD					
	B	9	A32		NSD							NSD					
	B	10	A2		NSD							NSD					
	B	11	D22		NSD							NSD					
	B	12	B31		NSD							NSD					
	B	13	B1		NSD							NSD					
	B	14	C21		NSD							NSD					
	B	15	B13		NSD							NSD					
	B	16	C3		NSD							NSD					
	C	17	B23	CDQ	1	1	F	1	0.05	20		NSD					
	C	18	B43		NSD							NSD					
	C	19	B3		NSD							NSD					
	C	20	C13	AZQ	2		MD1-1	6	6	1							
	C	20	C13	AZQ		2	MF	8	0.75	11							
	C	20	C13								AQ	3	3	F	4.5	0.38	12
	C	21	C33		NSD							NSD					
	C	22	C42		NSD							NSD					
	C	23	C22		NSD							NSD					

Final
CC2-H6-1CP-100504

Count	Original Analysis										QA Analysis						
	Gr	No.	Loc	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
	A	1	A11		NSD												
	A	2	A20		NSD												
1	A	3	B21	CDQ	1	1	F	0.75	0.1	7.5	CD	1	1	F	0.8	0.11	7.3
2	A	3	B21	CM	2		MD1-0	4	2.5	1.6	CD	2		MD1-0	4	3.8	1.1
	A	3	B21	CM		2	MF	2	0.05	40	CD		2	MF	1	0.05	20
	A	4	C2	CM	3		MD2-0	2.5	2	1.2							
	A	4	C2	CM		3	MB	1.5	0.15	10							
	A	5	C21								AQ	3	3	F	4	0.6	6.7
3	A	5	C21	CDQ	4	4	F	0.65	0.05	13	CD	4	4	F	0.6	0.08	7.5
	A	6	D10		NSD												
	B	7	B20		NSD												
4	B	8	B23	CD	5		MD1-0	4	2.5	1.6	CDQ	5		MD1-0	3.5	2	1.8
	B	8	B23	CD		5	MF	2	0.07	29	CDQ		5	MF	2	0.08	25
	B	8	B23								CD	6	6	F	0.6	0.08	7.5
	B	8	B23								AQ	7	7	F	5.3	0.4	13
5	B	9	B3	CDQ	6	6	F	1.05	0.05	21	CD	9	9	F	1	0.08	12
6	B	9	B3	AZQ	7	7	F	12	0.75	16	AQ	10	10	F	12	0.8	15
7	B	9	B3	CDQ	8		MD1-0	1.5	1.5	1	CDQ	8		MD1-0	1.8	1	1.8
	B	9	B3	CDQ		8	MF	1.5	0.1	15	CDQ		8	MF	1.8	0.05	36
	B	9	B3	CMQ	9		MD1-0	2.5	2	1.2							
	B	9	B3	CMQ		9	MF	2.5	0.05	50							
	B	9	B3								CD	11		MD1-0	1.5	0.8	1.9
	B	9	B3								CD		11	MF	0.7	0.1	7
	B	10	C21	CMQ	10	10	F	0.5	0.05	10							
8	B	10	C21	ADQ	11	11	F	2	0.3	6.7	AQ	13	13	F	2	0.38	5.3
	B	11	C10								CD	12		MD1-0	1.8	1	1.8
	B	11	C10								CD		12	MF	1.8	0.08	22
	B	11	C10	CMQ	12	12	F	1.6	0.05	32							
	B	12	D11	CDQ	13		MD2-0	2.5	1.75	1.4							
	B	12	D11	CDQ		13	MF	0.75	0.05	15							
	B	12	D11	CDQ		14	MF	0.6	0.05	12							
	B	12	D11								CD	14	14	F	0.5	0.08	6.2

Final

CC2-L6-1CA-100504

Count	Original Analysis									QA Analysis							
	Gr	No.	Loc	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
	A	1	B42		NSD												
	A	2	B22		NSD												
	A	3	B2		NSD												
	A	4	C12		NSD												
	A	5	C32		NSD												
	A	6	C41								CMQ	1	1	F	0.6	0.1	6
1	A	6	C41	ADQ	1	MD1-0	20	15	1.3	AQ	2	2	MD1-0	18	8	2.2	
	A	6	C41	ADQ		1	MF	4	0.75	5.3	AQ		2	MF	4.8	1.2	4
	A	6	C41	ADQ	2	MD1-0	20	15	1.3								
	A	6	C41	ADQ		2	MF	1.5	0.5	3							
	A	7	C21								AQ	3	3	F	6	1.58	3.8
	A	7	C21	CDQ	3	3	F	1	0.05	20							
	A	7	C21	CM	4	MD1-0	20	20	1								
	A	7	C21	CM		4	MF	0.65	0.05	13							
	A	8	C1		NSD												
	A	9	B11		NSD												
2	A	10	B31	CM	5	5	F	1	0.01	100	CD	5	5	F	1	0.03	33
	A	10	B31								AQ	4	4	F	5	0.75	6.7
	A	10	B31	ADQ	6	MD1-0	6	6	1								
	A	10	B31	ADQ		6	MF	5	0.85	5.9							
	A	11	A41		NSD						AQ	6	6	F	3.3	1	3.3
	A	12	A21	CM	7	MD2-0	15	6	2.5								
	A	12	A21	CM		7	MF	0.75	0.05	15							
	A	12	A21	CDQ		8	MB	2	0.15	13							
3	A	12	A21	CM	8	MD1-0	2.5	2	1.2	CD	7	7	MD1-0	2	0.5	4	
	A	12	A21	CM		9	MF	0.75	0.1	7.5	CD		7	MF	0.75	0.05	15
	A	12	A21								CD	8	8	MD1-0	20	15	1.3
	A	12	A21								CD		8	MF	1.8	0.1	18
4	A	13	A1	CM	9	10	F	0.75	0.05	15	CD	9	9	F	0.6	0.1	6
	A	13	A1	AZQ	10	11	F	1	0.2	5							
	A	13	A1								AQ	10	10	MD1-0	9	6	1.5
	A	13	A1								AQ		10	MF	4.5	0.6	7.5
5	A	14	D11	AQ	11	MD1-1	20	15	1.3	OQ	11	11	MD1-1	18	8.5	2.1	
	A	14	D11	AQ		12	MF	15	2	7.5	OQ		11	MF	14	2.5	5.6
	A	15	D31	CM	12	MD1-0	8	8	1								
	A	15	D31	CM		13	MF	1	0.05	20							
	A	15	D31								CD	12	12	MD2-0	3	1.8	1.7
	A	15	D31								CD		12	MF	0.7	0.01	70
	A	15	D31								CD		13	MF	0.5	0.01	50
	A	15	D31								CD	13	14	F	1.1	0.08	14
	B	16	B44		NSD						CD	14	14	MD1-0	3.5	1.5	2.3
	B	16	B44								CD		15	MF	1.1	0.1	11
	B	17	B24		NSD												
6	B	18	B4	ADQ	13	14	F	10	1	10	AQ	15	16	F	9.3	1	9.3
7	B	19	C14	CM	14	MD1-0	4	1.2	3.3	CD	17	17	MD1-0	3.2	1.5	2.1	
	B	19	C14	CM		15	MF	3	0.15	20	CD		18	MF	3.2	0.11	29
	B	19	C14								CD	16	16	MD1-0	4	3	1.3
	B	19	C14								CD		17	MF	0.8	0.08	10
	B	20	C34	ADQ	15	MD1-0	10	10	1								
	B	20	C34	ADQ		16	MF	4.5	0.5	9							
	B	20	C34								AQ	18	19	F	4.3	0.5	8.6
	B	20	C34								AQ	19	20	F	5	1.5	3.3
	B	21	C43	CD	16	MD1-0	3	3	1								
	B	21	C43	CD		17	MF	2.5	0.15	17							
	B	21	C43	AQ	17	MD2-0	10	7.5	1.3								
	B	21	C43	AQ		18	MF	4.5	0.65	6.9							
	B	21	C43	AQ		19	MF	2.5	0.4	6.2							
	B	21	C43								CD	20	21	F	2.8	0.1	28
	B	21	C43								AQ	21	21	MD1-0	7	6	1.2
	B	21	C43								AQ		22	MF	4.5	0.6	7.5
	B	21	C43								AQ	22	23	F	2.5	0.38	6.6
	B	22	C23	CD	18	MD1-0	20	20	1		NSD						
	B	22	C23	CD		20	MF	0.65	0.05	13							
8	B	23	C3	CM	19	21	F	1.5	0.05	30	CD	23	24	F	1.2	0.1	12
	B	23	C3	CM	20	MD1-0	5	5	1								
	B	23	C3	CM		22	MF	1.5	0.01	150							
	B	23	C3								CD	24	25	F	1.2	0.01	120
	B	23	C3								CD		25	F	0.9	0.08	11
	B	24	B13		NSD						CD	26	27	F	0.8	0.1	8
	B	25	B33		NSD												
9	B	26	B42	CM	21	MD2-0	3.5	3.5	1	CD	27	27	MD2-0	4	3	1.3	
	B	26	B42	CM		23	MF	1	0.05	20	CD		28	MF	1	0.1	10
	B	26	B42	CM		24	MF	1	0.05	20	CD		29	MF	0.8	0.08	10

Final

SFBC-H2-1FD-100604

Count	Original Analysis									QA Analysis							
	Gr	No	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
1	A	1	A2	CDQ	1	1	F	2.6	0.04	65	CD	3	3	F	2.6	0.03	87
2	A	1	A2	CD	2	2	F	0.51	0.04	13	CD	4	4	F	0.52	0.11	4.7
	A	2	A4		NSD												
3	A	3	A23	AZQ	3	3	F	9	1	9	AD	11	11	F	9	0.8	11
	A	3	A23	ADQ	4		MD1-1	50	25	2							
	A	3	A23	ADQ	4		MF	9	1.2	7.5							
	A	4	A42	CM	5	5	F	1	0.05	20							
	A	4	A42	CM	6	6	F	0.5	0.05	10							
	A	4	A42								CD	1		MD1-0	9	6	1.5
	A	4	A42								CD	1	1	MF	0.6	0.01	60
	A	5	A22	CM	7		MD1-0	50	25	2							
	A	5	A22	CM	7		MF	3.5	0.1	35							
	A	5	A22	CM	8	8	F	0.5	0.05	10							
	A	5	A22								CD	2		MD1-0	8	5	1.6
	A	5	A22								CD	2	2	MF	3	0.1	30
	A	7	D12		NSD												
	A	8	D32		NSD												
	A	9	D31	CD	9		MD2-0	6	5	1.2							
	A	9	D31	CM		9	MF	1.5	0.1	15							
	A	9	D31	CD		10	MF	0.6	0.1	6							
	A	9	D31	CM	10		MD1-0	2.5	2.5	1							
	A	9	D31	CM		11	MF	1	0.1	10							
	A	10	D1	CM	11	12	F	3	0.01	300							
4	A	10	D1	CD	12	13	F	0.5	0.05	10	CD	6	6	F	0.5	0.02	25
	A	10	D1	CD	13	14	F	2.5	0.05	50							
5	A	10	D1	CD	14	15	F	0.8	0.05	16	CD	8	8	F	0.6	0.11	5.5
6	A	10	D1	CM	15		MD1-0	7.5	5	1.5	CD	10		MD1-0	9.5	4	2.4
	A	10	D1	CM		16	MF	1.5	0.01	150	CD		10	MF	1.5	0.1	15
	A	10	D1								CD	7	7	F	1.3	0.05	26
	A	10	D1								CD	9	9	F	1	0.08	12
	A	11	A1		NSD												
	A	12	A11	CM	16	17	F	0.6	0.05	12							
	A	12	A11	CM	17	18	F	0.5	0.01	50							
	A	12	A11								CD	5		MD1-0	10	5	2
	A	12	A11								CD		5	MF	2	0.12	17
7	A	13	A21	CM	18		MD1-0	10	10	1	CD	13		MD1-0	9	5	1.8
	A	13	A21	CM		19	MF	1	0.1	10	CD		13	MB	0.6	0.15	4
8	A	13	A21	CD	19	20	F	0.5	0.05	10	CD	12	12	F	0.8	0.05	16
	A	13	A21	CD	20		MD1-0	40	20	2							
	A	13	A21	CD		21	MF	2.5	0.1	25							
	A	13	A21	CM	21	22	F	0.5	0.05	10							
	A	13	A21	CM							CD	14		MD1-0	4	3	1.3
	A	13	A21	CM							CD		14	MF	3	0.08	38
	A	13	A21	CM							AD	15		MD1-1	20	15	1.3
	A	13	A21	CM							CD		15	MF	10.5	1.8	5.8
	A	14	A31		NSD												
	A	15	A40	CQ	22		MD3-0	15	15	1							
	A	15	A40	CQ		23	MB	2.5	0.25	10							
	A	15	A40	CD		24	MF	1	0.05	20							
	A	15	A40	CM		25	MF	1	0.01	100							
9	A	15	A40	CM	23	26	F	1	0.01	100	CD	16	16	F	1.2	0.1	12
	A	15	A40								CD	17	17	F	0.7	0.08	8.8
10	B	16	B10	CD	24	27	F	1	0.15	6.7	CD	23	23	F	1.1	0.13	8.5
11	B	16	B10	CMQ	25		MD1-0	2.7	1.8	1.5	CD	24		MD1-0	2.7	1.8	1.5
	B	16	B10	CMQ		28	MF	2.7	0.15	18	CD		24	MF	2.7	0.15	18
	B	17	B30		NSD												
12	B	18	B42	CD	26	29	F	2	0.1	20	CD	19	19	F	1.8	0.1	18
	B	18	B42								CD	18	18	F	0.7	0.08	8.8
13	B	19	B22	CD	27	30	F	1.2	0.1	12	CMQ	20	20	F	1.3	0.1	13
	B	19	B22	ADQ	28	31	F	5.4	1	5.4							
14	B	19	B22	CD	29		MD1-1	10	5.5	1.8	CMQ	21		MD1-0	15	7	2.1
	B	19	B22	CD		32	MF	5.1	0.08	64	CMQ		21	MF	4	0.11	36
	B	20	B2		NSD												
	B	21	C12		NSD												
15	B	22	C32	CMQ	30	33	F	2.3	0.2	12	AQ	22	22	F	2.4	0.12	20
	B	22	C32	CD	31	34	F	1.7	0.1	17							
16	B	23	C40	CD	32		MD1-0	4	3	1.3	CD	25		MD1-0	4	3.2	1.2
	B	23	C40	CD		35	MF	3	0.08	38	CD		25	MF	3	0.09	33

Final
JOGB-H2-5TR-100704

Count	Original Analysis										QA Analysis						
	Gr	No.	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
	A	1	B44		NSD												
	A	2	B24		NSD												
	A	3	B4		NSD												
1	A	4	C14	AZQ	1	1	F	1.2	0.2	6	AQ	2	2	F	1.2	0.38	3.2
2	A	4	C14	AQ	2	2	F	0.7	0.2	3.5	AQ	1	1	F	0.75	0.25	3
	A	5	C34		NSD												
	A	6	C43		NSD												
	A	7	C23		NSD												
	A	8	C3		NSD												
	A	9	B13		NSD												
	A	10	B33		NSD												
	A	11	B42		NSD												
3	A	12	B22	AQ	3		MD1-1	12	3	4	AQ	3		MD1-1	12	3.8	3.2
	A	12	B22	AQ		3	MF	7	0.55	13	AQ		3	MF	7.8	0.6	13
	B	13	B44		NSD												
	B	14	B24		NSD												
	B	15	B4		NSD												
	B	16	C14		NSD												
4	B	17	C34	AQ	4		MD1-0	2	1.5	1.3	AQ	4		MD1-0	2	1	2
	B	17	C34	AQ		4	MF	2	0.4	5	AQ		4	MF	2	0.38	5.3
	B	18	C43	AQ	5	5	F	3	0.95	3.2							
	B	19	C23		NSD												
	B	20	C3		NSD												
	B	21	B13		NSD												
	B	22	B33		NSD						CD	5	5	F	1.3	0.08	16
	B	23	B42		NSD												

Final
CPS-H2-4FD-100704

Count	Original Analysis										QA Analysis						
	Gr	No.	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
	A	1	A43		NSD												
	A	2	A13		NSD												
1	A	3	D3	AZQ	1	1	F	1.5	0.3	5	AQ	1	1	F	1.7	0.3	5.7
	A	4	D33	AQ	2	2	F	2.8	0.6	4.7		NSD					
	A	5	D41		NSD							NSD					
	A	6	D11		NSD							NSD					
	A	7	A21		NSD							NSD					
	A	8	B40		NSD							NSD					
	A	9	B10		NSD							NSD					
	A	10	C20		NSD							NSD					
	A	11	C42		NSD							NSD					
	A	12	C12		NSD							NSD					
	B	13	A43	CDQ	3		MD1-0	5.2	2	2.6							
	B	13	A43	CDQ		3	MB	2.5	0.15	17							
	B	13	A43								CD	2		MD1-0	5.5	3.5	1.6
	B	13	A43								CD		2	MF	1	0.1	10
2	B	14	A13	AQ	4	4	F	9.5	1.8	5.3	AQ	4	4	F	9	1.8	5
	B	14	A13	AQ	5	5	B	2.5	0.7	3.6							
	B	14	A13								AQ	3	3	F	2	0.6	3.3
	B	15	D3		NSD							NSD					
	B	16	D33		NSD							NSD					
	B	17	D40		NSD							NSD					
3	B	18	D10	AQ	6	6	F	13	2	6.5	AQ	5	5	F	11.5	1.8	6.4
	B	19	A20		NSD							Not Analyzed					
	B	20	B31		NSD							NSD					
	B	21	C1		NSD							NSD					
	B	22	C30		NSD							NSD					
4	B	23	C32	AQ	7	7	F	2.6	0.5	5.2	AQ	6	6	F	2.5	0.5	5

Final
CPS-H2-14FD-100704

Count	Original Analysis										QA Analysis						
	Gr	No.	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
1	A	1	A21		NSD							NSD					
	A	2	A42	AZQ	1	1	F	7	2	3.5	AQ	1	1	F	5.8	1.7	3.4
	A	3	A2		NSD							NSD					
	A	4	D22		NSD							NSD					
	A	5	D42		NSD							NSD					
	A	6	D41		NSD							NSD					
	A	7	D11		NSD							NSD					
	A	8	B10		NSD							NSD					
	A	9	B40		NSD							NSD					
	A	10	B12		NSD							NSD					
	A	11	C12		NSD							NSD					
	B	12	C10		NSD							NSD					
	B	13	C30		NSD							NSD					
B	14	D41	AQ		2	2	F	2.7	0.18	15							
B	14	D41									AQ	2	MD1-0	3.8	1	3.8	
B	14	D41									AQ		2 MF	3.8	0.2	19	
B	15	D11		NSD							NSD						
B	16	A11		NSD							NSD						
B	17	A41		NSD							NSD						
B	18	B40		NSD							NSD						
B	19	B10		NSD							Not Analyzed						
B	20	B2		NSD							NSD						
B	21	B32		NSD							NSD						
2	B	22	B34	AQ	3	3	F	14	4	3.5	AQ	3	3	F	13	3.8	3.4
			C10		Not Analyzed							NSD					

Final
CPS-H2-1PG-100704

Count	Original Analysis										QA Analysis						
	Gr	No.	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
1	A	1	A22	AZQ	1	1	F	4.5	0.5	9	AQ	1	1	F	4.7	0.6	7.8
	A	2	D2		NSD												
	A	3	D22		NSD												
	A	4	D40		NSD												
	A	5	D10		NSD												
	A	6	A20		NSD												
2	A	7	A40	AQ	2	2	F	0.9	0.2	4.5	AQ	2	2	F	0.9	0.25	3.6
	A	8	C10		NSD												
	A	9	C40		NSD												
	A	10	C32		NSD												
	A	11	B2		NSD												
	A	12	B22		NSD												
	B	13	A2		NSD												
	B	14	D22		NSD												
	B	15	D40		NSD												
	B	16	D10		NSD												
	B	17	A20	CDQ	3	3	F	1	0.05	20							
3	B	17	A20	CDQ	4	4	F	1.4	0.06	23	CQ	3	3	F	1.5	0.05	30
	B	17	A20	CMQ	5	5	F	0.7	0.05	14							
	B	18	B41		NSD												
	B	19	B11		NSD												
	B	20	C21		NSD												
	B	21	C42		NSD												
	B	22	C12		NSD												
	B	23	B12		NSD												

Final
CC6-H6-2CP-100704

Count	Original Analysis										QA Analysis						
	Gr	No.	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
1	A	1	B42	AZQ	1	1	F	8.5	1.3	6.5	AQ	1	1	F	7.5	1.35	5.6
	A	2	B12		NSD							NSD					
	A	3	D11		NSD							NSD					
	A	4	D31		NSD							NSD					
	A	5	A40		NSD							NSD					
	A	6	A20		NSD							NSD					
	B	7	B41		NSD							NSD					
2	B	8	B21	ADQ	2	2	F	4	0.35	11	AQ	2	2	F	3.8	0.35	11
	B	9	C1		NSD							NSD					
	B	10	D1		NSD							NSD					
	B	11	D21		NSD							NSD					

Final
CC6-L6-1CA-100704

Count	Original Analysis										QA Analysis						
	Gr	No.	Loc.	ID	Prim	Tot	Class	Len	Wid	Asp	ID	Prim	Tot	Class	Len	Wid	Asp
	A	1	B33		NSD							NSD					
	A	2	B13		NSD							NSD					
	A	3	C3		NSD							NSD					
	A	4	C23		NSD							NSD					
	A	5	C43		NSD							NSD					
	A	6	A21		NSD							NSD					
	A	7	A11		NSD							NSD					
1	A	8	D1	AZQ	1	1	F	1.7	0.4	4.2	AQ	1	1	F	1.6	0.45	3.6
2	A	9	D21	AZQ	2		MD1-1	11	8	1.4	AQ	2		MD1-1	10	6	1.7
	A	9	D21	AZQ		2	MF	5.2	1.2	4.3	AQ		2	MF	5.5	1.3	4.2
	A	10	A32		NSD							NSD					
	A	11	A22		NSD							NSD					
	A	12	A2		NSD							NSD					
	A	13	D2		NSD							Not Analyzed					
	A	14	D12		NSD							NSD					
3	A	15	D22	ADQ	3		MD1-1	11.5	7	1.6	AQ	3		MD1-1	10.8	7	1.5
	A	15	D22	ADQ		3	MF	7	0.8	8.8	AQ		3	MF	6.5	0.75	8.7
	B	16	B44		NSD							NSD					
	B	17	B24		NSD							NSD					
	B	18	B4	ADQ	4	4	F	5.8	0.7	8.3		NSD					
	B	19	C14		NSD						AQ	4	4	F	5.8	0.7	8.3
	B	20	B43		NSD							NSD					
	B	21	B33		NSD							NSD					
	B	22	B23		NSD							NSD					
	B	23	B13		NSD							NSD					
4	B	24	B3	ADQ	5	6	F	2	0.35	5.7	AQ	5	5	F	2	0.2	10
5	B	25	B42	CDQ	6	6	F	1	0.05	20	CD	6	6	F	1.1	0.05	22
	B	26	B32		NSD							Not Analyzed					
	B	27	B22		NSD							NSD					
	B	28	B12		NSD							NSD					
	B	29	B31		NSD							NSD					
	B	30	B21		NSD							NSD					

A. Appendix 2

Photographs showing the various El Dorado sample locations are contained in this Appendix. The photographs were taken from the Internet (<http://www.epa.gov/region9/toxic/noa/eldorado/intro1.html>) on August 29, 2005.



Figure 5-1 Fixed Ambient Outdoor Air Sampling Locations

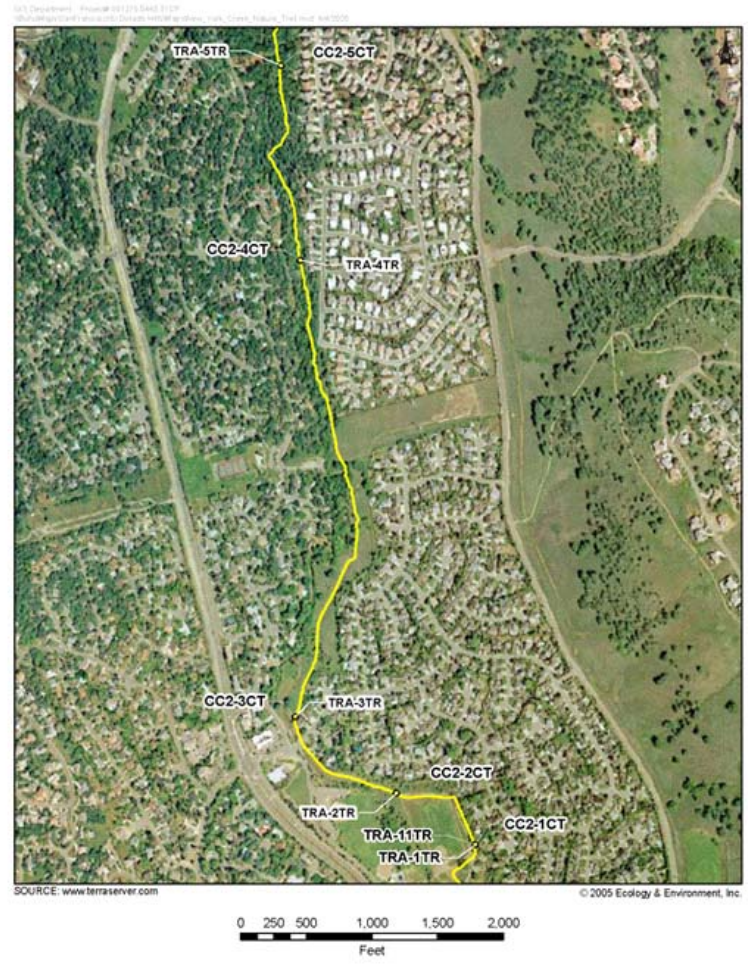


Figure 5-2 New York Creek Nature Trail Perimeter Monitoring Locations

Final



Figure 5-4 Silva Valley Elementary School Baseball Playing Field Activity-Based Outdoor Air Sampling Locations Maintenance Scenario



Figure 5-5 Silva Valley Elementary School Baseball Playing Field Activity-Based Outdoor Air Sampling Locations Baseball Scenario A





Figure 5-7 Rolling Hills Middle School Soccer Field Activity-Based Outdoor Air Sampling Locations Soccer Scenario



Figure 5-8 Rolling Hills Middle School Activity-Based Outdoor Air Sampling Locations Basketball Scenario



SOURCE: USEPA

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Figure 5-10 Community Park North Field Activity-Based Outdoor Air Sampling Locations Baseball Scenario



SOURCE: USEPA 2004

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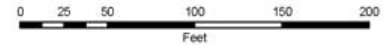


Figure 5-11 Community Park South Field Activity-Based Outdoor Air Sampling Locations Baseball Scenario A



Figure 5-12 Community Park South Field
Activity-Based Outdoor Air Sampling Locations
Baseball Scenario B



Figure 5-13 Community Park South Field
Activity-Based Outdoor Air Sampling Locations
Baseball Scenario C (Without Field Maintenance)



Figure 5-14 Community Park New York Creek Field
 Activity-Based Outdoor Air Sampling Locations
 Baseball Scenario

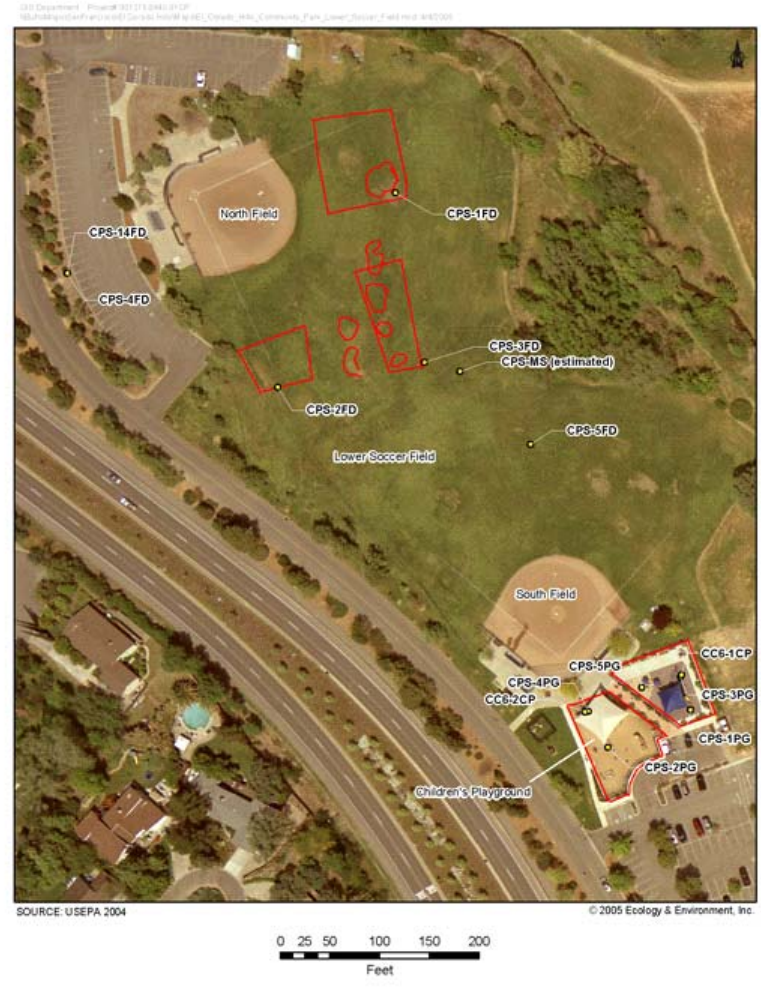
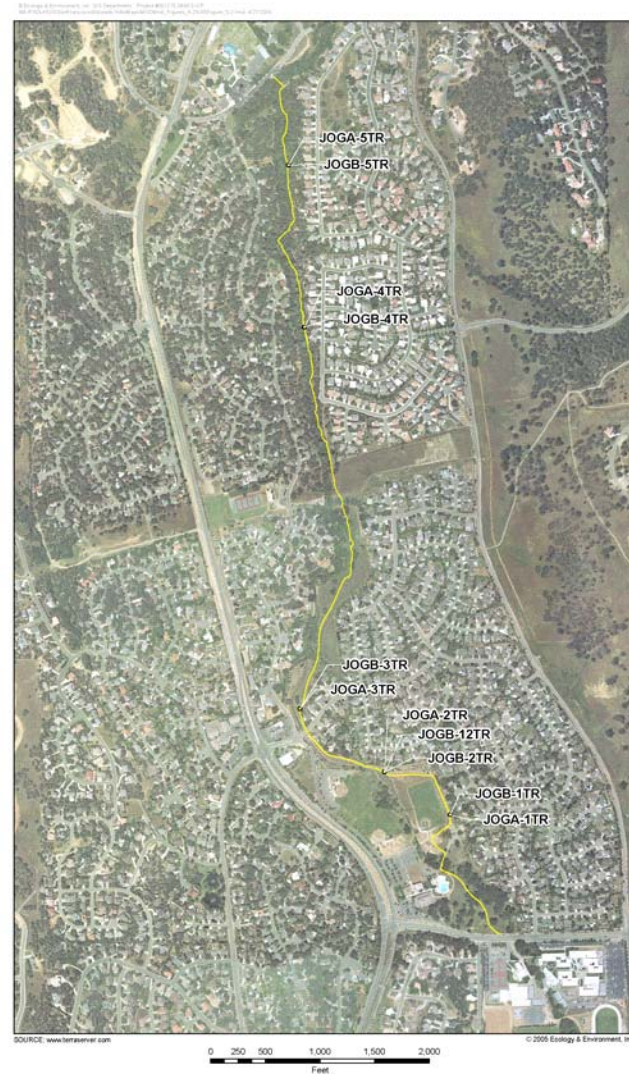


Figure 5-15 Community Park Lower Soccer Field
 Activity-Based Outdoor Air Sampling Locations
 Soccer Scenario



**Figure 5-16 New York Creek Nature Trail
Activity-Based Outdoor Air Sampling Locations
Biking Scenario**



**Figure 5-17 New York Creek Nature Trail
Activity-Based Outdoor Air Sampling Locations
Jogging/Walking Scenarios**



Figure 5-21 Silva Valley Elementary School Baseball Playing Field
Soil Sample Locations



Figure 5-22 Rolling Hills Middle School Soccer Field
Soil Sample Locations



Figure 5-23 Community Park North Field
Soil Sample Locations



Figure 5-24 Community Park South Field
Soil Sample Locations



Figure 5-25 Community Park New York Creek Field
 Soil Sample Locations



Figure 5-26 Community Park Lower Soccer Field
 Soil Sample Locations

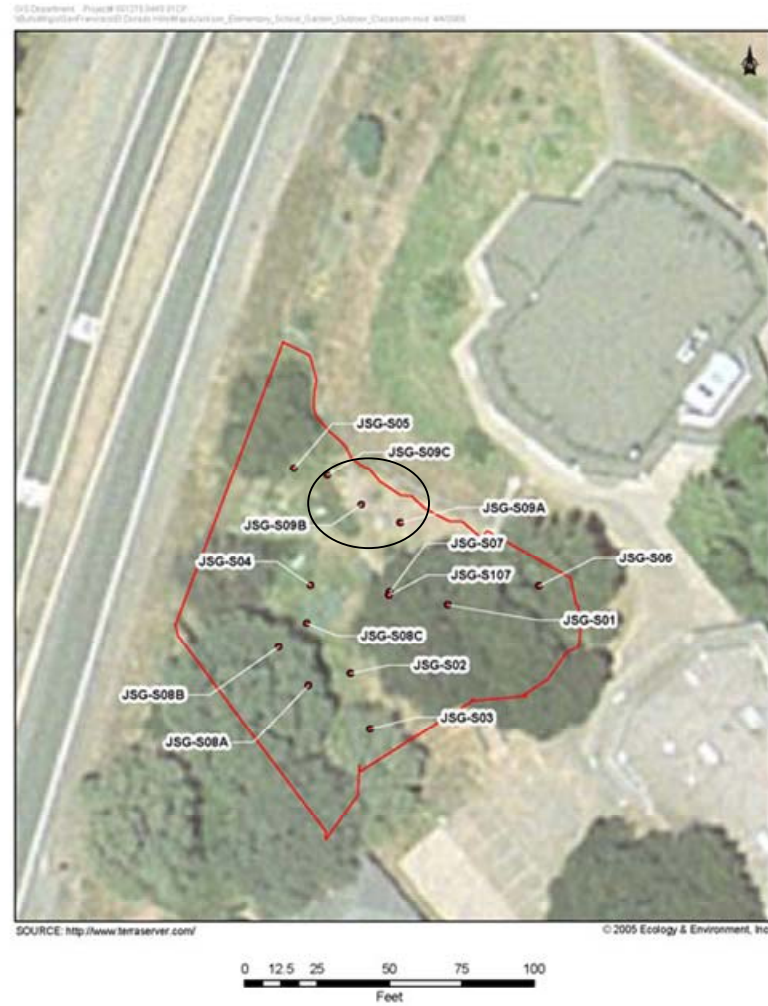
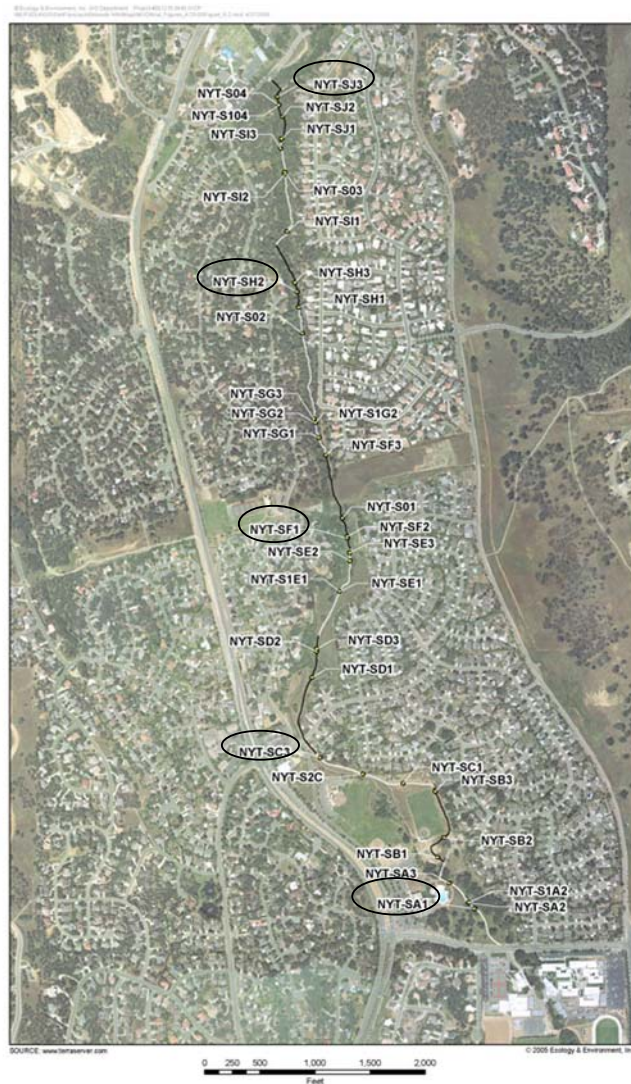




Figure 5-29 Jackson Elementary School
Grass-Covered Playing Field Soil Sample Locations



Figure 5-30 Dirt Embankment
Soil Sample Locations

