United States
Environmental Protection
Agency

Office of Prevention,
Pesticides and
Toxic Substances (7401)

EPA 744-R-00-010
August 2000
www.epa.gov

Sampling and Analysis of Consumer Garden Products That Contain Vermiculite

FOREWORD

EPA'S INVESTIGATION OF ASBESTOS-CONTAMINATED VERMICULITE

The Environmental Protection Agency has conducted sampling of vermiculite products, primarily those used in gardening, to determine if products currently on the market contain asbestos, and if so, whether consumers are at risk from using these products. To evaluate the risk posed by compounds such as asbestos, EPA needs to determine if the contaminant is present in certain products and also whether people come in contact with sufficient quantities to cause harm. Asbestos poses a risk to people if fibers become airborne and are inhaled into the lungs. As described in more detail below, and in the accompanying reports, the results of this investigation indicate that the potential exposure to asbestos from vermiculite products poses only a minimal health risk to consumers, although workers may face more serious risks.

Vermiculite is produced from mined ore and is used in agricultural and horticultural products as well as in insulation and construction applications. As a first step in the process, the Agency purchased and began testing a limited number of vermiculite products available in garden stores in the Seattle area to determine if they were contaminated with asbestos. Sixteen products were tested using widely-recognized standard protocols and asbestos was detected in five of them. However, only three of these contained enough asbestos to allow EPA to quantify the percentage of asbestos reliably.

To determine whether the asbestos fibers in these three products could become airborne and present a potential exposure hazard during use, EPA's Seattle office placed the products into a glove box, a small, enclosed metal box with gloves, and handled them as they would during normal use. EPA collected and analyzed air samples, and determined that one of the products tested generated relatively high levels of asbestos. This finding prompted the Seattle office to recommend that consumers refrain from using that particular vermiculite chemical packaging material. This product is apparently no longer available to consumers at garden stores.

EPA then decided to expand the scope of its analysis, to include additional vermiculite products available nationally, and to calculate the risk posed in cases where airborne asbestos fibers were detected during product handling. The Agency, through its expert contractors, purchased and analyzed 38 products from around the country and detected asbestos in 17 of them. Of these, only five contained quantifiable levels of asbestos. EPA scientists, along with the contractors, then conducted two simulated consumer use scenarios. One simulation was performed indoors in a "still air" environment (a 10'x10'x10' enclosure) in an attempt to represent consumer use in a small garage or greenhouse. The other simulation was performed outside in open air.

As described in the attached report, there is a lot of variability in the observed results. In some cases, one sample of a product indicated the presence of asbestos while another did not. This variability is likely due to a number of factors including the following: (1) the asbestos content of the vermiculite products appears to be very close to the technological limit of detection, so one test might detect the presence of asbestos while a second one would not; (2) only a very small portion (0.01 grams) of each product is actually viewed under the microscope, although individual bags may

contain up to several cubic meters; (3) the bagged product is not homogeneous; (4) different processing facilities use different dust removal techniques; (5) there are differences in the asbestos content of vermiculite ore from different mines; and (6) asbestos content varies throughout the vermiculite deposits in each mine.

The results of this investigation indicate that consumers face only a minimal health risk from using vermiculite products at home or in their gardens. Vermiculite may, however, present more serious risks in an occupational setting, where the duration and frequency of exposures are likely to be significantly greater. EPA is concerned about potential occupational exposures and has provided this report to OSHA to assist that agency in evaluating the hazards to workers from vermiculite.

To further reduce the low risk associated with the occasional use of vermiculite products during gardening activities, EPA recommends that consumers:

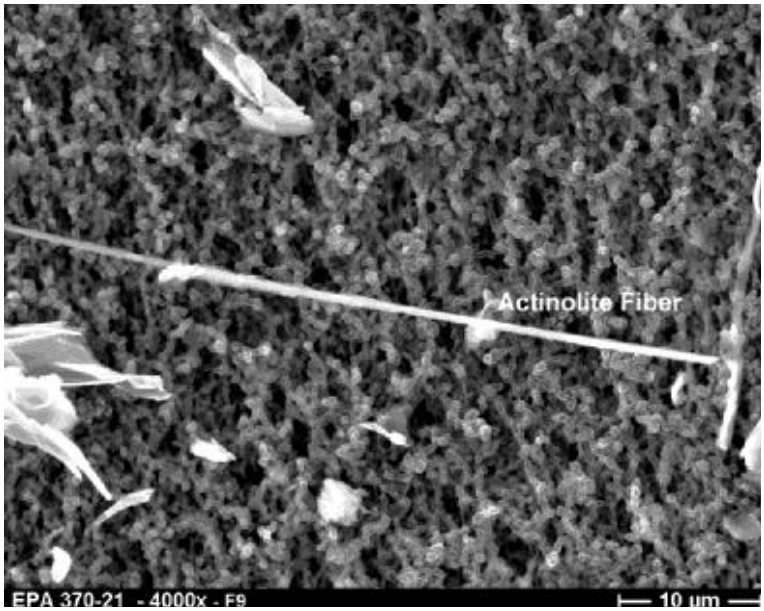
- Use vermiculite outdoors or in a well-ventilated area.
- Avoid creating dust by keeping vermiculite damp during use.
- Avoid bringing dust into the home on clothing.

Although EPA does not endorse the use of any particular product, consumers may choose to use:

- Premixed potting soils, which ordinarily contain more moisture and less vermiculite than pure vermiculite products and are less likely to generate dust.
- Soil amendment materials other than vermiculite, such as peat, sawdust, perlite, or bark.

The following reports describe the sampling and analysis of vermiculite products conducted by EPA. The first attachment is the report of the sampling conducted by EPA's Seattle office. The second is the report of the national sampling performed for EPA by its contractor, Versar, Inc.

REGION 10 INVESTIGATION OF ASBESTOS IN VERMICULITE



July 26, 2000

U.S. Environmental Protection Agency
Region 10, Office of Environmental Assessment
Investigation and Engineering Unit
Seattle, WA

Jed Januch and Keven McDermott
Investigators

ACKNOWLEDGMENTS

We received tremendous support and assistance from many of our co-workers at EPA. We would like to thank the following EPA Region 10 staff who contributed significantly to the quality of the Region 10 Investigation of Asbestos in Vermiculite: Lorraine Edmond, M.S., David Frank, Ph.D., Richard Mednick, J.D., David Terpening, Marion "Doc" Thompson, Michael Watson, Ph.D., Philip Wong, P.E., and Bruce Woods, Ph.D. We sincerely appreciate the contributions of Robert Jordan, Ph.D., EPA headquarters, who provided technical assistance.

We would also like to thank Susan Davis, Washington State Department of Ecology, and John Harris, MPH, and his staff at Lab/Cor, Inc. for analyzing our samples. We greatly appreciate the efforts of Janine Rees, Washington State Department of Labor and Industries, who helped design the air monitoring protocols used in the investigation.

Our special thanks to Rene Fuentes, P.E., EPA Region 10, Phillip Peters, MSPH, Washington State Department of Labor and Industries, and Christopher Weis, Ph.D., EPA Region 8, for their peer review of the Region 10 Investigation of Asbestos in Vermiculite report. Their technical expertise and attention to detail was invaluable in crafting our final report.

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EXECUTIVE SUMMARY

In January 2000 the Environmental Protection Agency Region 10 office in Seattle, Washington, began testing a limited number of lawn and garden products that contain vermiculite to see if these products were contaminated with asbestos. The investigation was prompted by calls from citizens who became concerned after reading a series of articles in the Seattle Post-Intelligencer about asbestos contaminated vermiculite. Many callers specifically asked if vermiculite products currently sold in the Seattle area contained asbestos, and if consumers could be exposed to asbestos when using these products.

Sixteen different products containing vermiculite were purchased at Seattle area retail stores. The products selected were available either regionally or nationally. Samples from the products were analyzed using two different types of microscopes. Five of the products were contaminated with asbestos.

Three of the five products that contain measurable amounts of asbestos underwent further testing. EPA investigators worked with these products in a confined area to simulate how a typical consumer might use them, while air monitoring samples were taken. This was done to determine whether asbestos present in the vermiculite could become airborne during use and possibly expose the consumer to asbestos. One of the three asbestos-contaminated products tested by Region 10 released asbestos fibers into the air. The other two products tested did not.

The results of the EPA Region 10 investigation show some vermiculite products currently on the market contain asbestos. The amount and types of asbestos found in the vermiculite products tested by Region 10 varies. Because consumers have no way of knowing which vermiculite products contain asbestos and which do not, EPA Region 10 recommends that consumers follow basic precautions to reduce potential exposure to asbestos when handling vermiculite.

REGION 10 INVESTIGATION OF ASBESTOS IN VERMICULITE

INTRODUCTION

Vermiculite is the name of a mineral that has been mined commercially in the United States since the early 1920s. Vermiculite is often found with other minerals including various forms of asbestos. There are four active vermiculite mines in the United States. A fifth mine in Libby, Montana, closed in 1990, but ore may have been shipped from the mine until 1992.[1]

The Libby mine, formerly owned and operated by the W.R. Grace and Company, was known to contain deposits of fibrous tremolite asbestos. Between 1980 and 1991 there were several studies conducted for or by the Environmental Protection Agency dealing with sampling and analysis of vermiculite, the potential for exposure to asbestos through consumer and occupational use of vermiculite, and possible health effects associated with exposure to asbestos-contaminated vermiculite. These studies indicated that other vermiculite mines in the United States may also be contaminated with asbestos.[2]

In November 1999 the Seattle Post-Intelligencer published a detailed series of articles about the vermiculite mine in Libby, Montana, and the miners and their families who died or became ill from exposure to asbestos in the vermiculite ore.[3] As a result of these articles EPA Region 10 received numerous calls from citizens who feared they might have been exposed to asbestos while working with vermiculite or from having it as insulation in their homes. Many callers specifically asked if vermiculite from the Libby mine is still being sold, whether the vermiculite insulation in their homes presents a health hazard, and whether vermiculite from other mines that is currently sold is also contaminated with asbestos.

These calls were referred to the Investigation and Engineering Unit (IEU) of the Office of Environmental Assessment. IEU investigators routinely receive tips and calls from citizens with environmental concerns or complaints, and conduct follow-up investigations. Because of the nature and volume of calls, the IEU began an investigation to see if vermiculite products currently sold in the Seattle area contain asbestos and, if so, could the asbestos present in those products become airborne during use.

The investigation had three distinct phases. In Phase I, investigators gathered information about vermiculite by reviewing available literature and conducting interviews. This information was used to help design the sampling and analytical protocols used in subsequent phases. In

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[1] U.S. Geological Survey, Vermiculite Minerals Yearbook, 1990. Michael J. Potter

[2] See references 5,8,9, and 10

[3] Andrew Schneider, Senior National Correspondent, (November 18, 1999). "Uncivil Action: A town left to die", *Seattle Post-Intelligencer*. p.1 Section A

Phase II, investigators purchased sixteen different vermiculite products, took samples from each product, and had the samples analyzed to see if asbestos was present. Those products that were found to contain measurable amounts of asbestos went through additional testing. In Phase III, investigators simulated the use of the contaminated products in a contained area while taking air monitoring samples, and had those samples analyzed to see if asbestos present in the bulk material became airborne during use.

PHASE I

During Phase I geologists with the Region 10 Office of Environmental Assessment assisted IEU investigators in identifying historical and technical literature about vermiculite mines and potential for asbestos contamination at those mines. The documents reviewed by IEU investigators are listed in the references section of this report. Region 10 geologists are also investigating the feasibility of using various analytical methods to trace vermiculite in consumer products to the mines from which it originated.

PROPERTIES OF VERMICULITE

Vermiculite is defined as a hydrated magnesium-aluminum-iron sheet silicate mineral of various compositions.[4] After vermiculite ore has been mined and crushed, it is sized and sorted, at which point it becomes known as vermiculite concentrate. The concentrate is shipped to processing plants, where it is expanded or exfoliated by heating it in a furnace to temperatures ranging between 1,600 to 2,000 degrees Fahrenheit.[5] After exfoliation its appearance is similar to a small, brown, accordion-shaped granule.

Vermiculite is resistant to combustion. Un-exfoliated vermiculite is used in various manufacturing processes including gypsum wallboard, paper products, coatings and cinder blocks. Exfoliated vermiculite is absorbent and lightweight. It is used in fireproofing, insulation, as a carrier for agricultural chemicals, as an ingredient in lawn and garden products, as a packaging material and as an underlayment for swimming pools.

Vermiculite deposits are found in similar geologic settings around the world. Many contain asbestiform minerals as contaminants. There are four active vermiculite mines in the United States. Two are located in the Enoree district of South Carolina, one in Louisa County Virginia, and one in Dillon, Montana. Previous geological studies, cited in references 3, 4, and 5 of this report, have established that all four of these mines contain asbestiform minerals.

[4] Vermiculite, Bureau of Mines Bulletin #675, 1985

[5] Vermiculite Association, http://vermiculite.org/aboutvermiculite.htm (2/9/00)

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PROPERTIES OF ASBESTOS

Asbestos is the name given to six different types of fibrous minerals that occur naturally in the environment.[6] The technical names for the six types of asbestos are listed in the Code of Federal Regulations.[7] Asbestos minerals are divided into two major groups - serpentine and amphibole, which differ from each other both physically and chemically.[8] The minerals in both groups are made up of fibers that vary in length and diameter. The amphibole group includes fibrous actinolite and tremolite, which are commonly associated with vermiculite as naturally occurring contaminants.

Asbestos has been mined for use in many types of manufactured products, including roofing and flooring materials, cement board, brake and transmission components, gaskets, pipe insulation, and heat-resistant fabrics. In these manufactured products asbestos is deliberately added as an ingredient.

Adverse health effects associated with exposure to asbestos have been known for many years. During the twentieth century the link between asbestos exposure and chronic respiratory disease has been clearly established. Inhalation of asbestos fibers has been shown to cause asbestosis, and can lead to increased risk of lung cancer and mesothelioma.[9]

The Environmental Protection Agency and the Occupational Safety and Health Administration are the two primary federal agencies that have promulgated regulations designed to reduce potential exposure to asbestos in the environment and in the workplace. Additional regulations have also been developed by state and local governments for the same purpose.

SUMMARY OF INTERVIEWS

Since the media coverage about asbestos in vermiculite began in November 1999, EPA Region 10 has received dozens of calls from citizens around the country, who were concerned that they might have been exposed to asbestos while working with vermiculite products. Calls came from hobby and professional gardeners, a hospital technician who uses vermiculite in prosthetic devices for children, several laboratory workers, people who installed vermiculite

[6] Toxicological Profile for Asbestos, ATSDR, Atlanta, GA

[7] 40 CFR Part 61 Subpart M section 61.141 “Asbestos means the asbestiform varieties of serpentine (chrysotile) riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite.”

[8] Asbestos NESHAP Inspection and Safety Procedures Workshop, Student Manual, APTI Course, Second Edition (Revised 1999)

[9] Toxicological Profile for Asbestos, ATSDR, Atlanta, GA

insulation in their attics, construction workers who used vermiculite, and former employees of vermiculite expansion plants. Many of the callers were from the Pacific Northwest, but some were from as far away as Florida, Tennessee, and Michigan. Callers described how they used vermiculite and discussed their specific health concerns. The information collected from the callers was important to help understand how vermiculite is processed and how individuals handle products that contain vermiculite. A summary of the information provided by these callers is included in Appendix 1 of this report.

PHASE II

Phase II of this investigation was designed to identify vermiculite products available to consumers through retail outlets in the Seattle metropolitan area, and to determine if the products selected for analysis are contaminated with asbestos. This was a limited study that looked at a relatively small number of products. The study was not statistically based. The information collected in Phase II was intended to help determine which products warranted further testing in Phase III, and to provide the rationale for future statistically based studies.

BULK SAMPLES OF VERMICULITE PRODUCTS

IEU investigators visited nine retail stores in the Seattle metropolitan area that sell lawn and garden products. Sixteen different vermiculite products were selected from store shelves and purchased. The selection was based on available products. There was no attempt made to target specific brands or manufacturers. Seven of the products contained vermiculite as the primary ingredient. The nine other products were potting soils that contained vermiculite as well as other ingredients. One of the sixteen products selected was Zonolite Chemical Packaging Vermiculite, which while labeled for use as a packaging material, was offered for sale to consumers in two different retail stores for home gardening use.

Prior to taking samples from the sixteen products, IEU investigators examined the different analytical methods used to analyze bulk materials for asbestos content. After consultation with Region 10 quality assurance staff and the microscopists who would later analyze the samples, IEU investigators made the decision to analyze bulk samples using a bulk test method for determination of asbestos in building materials.[10]

The sixteen vermiculite products were delivered under chain of custody to the Manchester Environmental Laboratory (MEL), located in Port Orchard, Washington, where they were sampled under a fume hood to prevent possible release of asbestos fibers. The samples were

[10] Method for the Determination of Asbestos in Bulk Building Materials, EPA600-R-93-116, Research Triangle Institute, July 1993

analyzed at MEL using stereo microscopic examination to determine homogeneity and preliminary fiber identification. Polarized light microscopy (PLM) was used to determine the optical properties of fibers and provide qualitative identification of suspect fibers. Samples were also analyzed at Lab/Cor, Inc. in Seattle, WA, using transmission electron microscopy (TEM) to positively identify and quantify the amount and type of asbestos present in the samples.

Three different groups of samples were taken from the sixteen products. MEL analyzed the first and second set of samples as rinsed residues. MEL did not analyze a third set of samples. Lab/Cor, Inc. analyzed the first and second set of samples it received as dust or particulate. The third set of samples sent to Lab/Cor, Inc. were analyzed as rinsed residues. The technique of preparing rinsed residue samples for analysis is described in the following section of this report.

The first group of samples were taken using an EPA technique for sampling dry products in bags.[11] These samples were intended to be representative or typical of the vermiculite product in the containers (bags). For this group of samples a hollow plastic tube approximately one inch in diameter was inserted diagonally through a hole in each bag, and cross sections of the contents were drawn out of the plastic tubes into new clean 4-ounce glass jars. For larger bags a stainless steel tube was used to remove the vermiculite from the bag. The jars containing the vermiculite products were labeled with laboratory sample numbers and EPA custody seals were placed over the lids of the containers. The samples were handled under standard chain of custody and submitted for analysis. One set from the first group of samples was sent to MEL for analysis, the other set was sent to Lab/Cor, Inc. Both MEL and Lab/Cor, Inc. received a quality assurance duplicate of two of the sixteen products. The bags of product from which the samples were taken were marked with laboratory sample numbers and stored in a locked sample custody area at MEL.

The second group of bulk samples was taken from three of the vermiculite products (Whitney Farms Vermiculite, Zonolite Chemical Packaging Vermiculite, and Therm-O-Rock Vermiculite) that were shown to be contaminated with asbestos during analysis of the first group of samples. For this group of samples approximately one to two quarts of vermiculite were taken from the bottom of the bag after it had been moderately shaken. The vermiculite was separated through a series of USA Standard Testing Sieves (size No.10 and No.35) so a sample of the fine material at the bottom of the bag could be segregated from the larger particles of vermiculite. The fines were collected in a pan at the bottom of the lower sieve and transferred into new, clean 2-ounce glass jars. Duplicate samples from the three products were delivered to both the MEL and Lab/Cor, Inc. under standard chain of custody and submitted for analysis. Quality assurance samples in the form of field duplicates were collected for two of the products. Cole's Cactus Mix was not included in this group because other components of the mix made it difficult to sift.

[11] Pesticide Product Enforcement Manual 1994 Chapter on Sampling

The technique used for the second group of samples was designed to isolate and analyze the fines that accumulate in the bottom of the bag. This was done to see if asbestos detected in a bag of vermiculite was evenly distributed throughout the bag or was present in higher concentrations in the lower fractions of the bag. These samples were not intended to be representative of the contents of the bag as a whole.

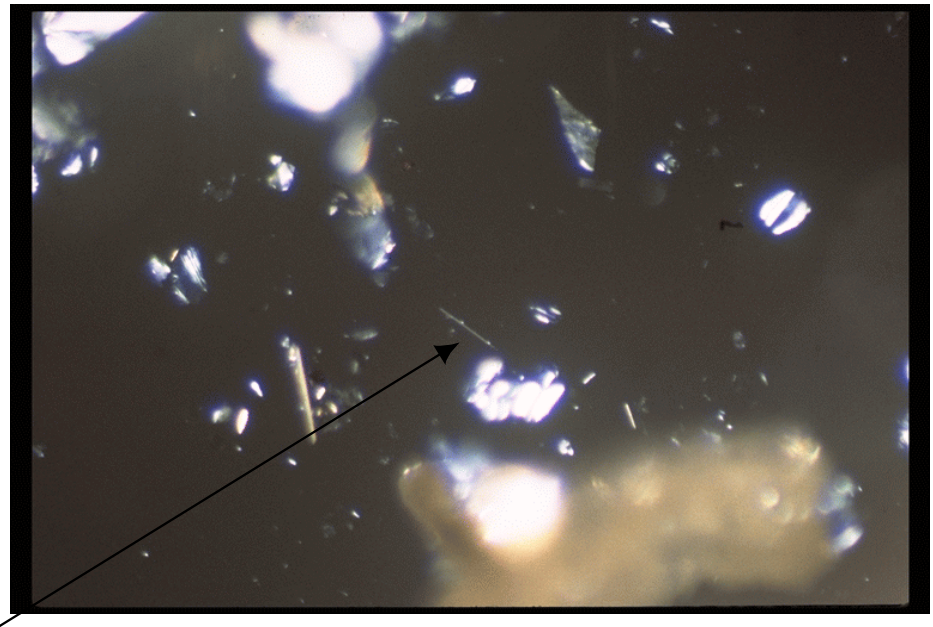
A third set of samples was prepared by MEL for Lab/Cor, Inc. MEL split the rinsed residue samples from group two, which consisted of samples taken previously from Whitney Farms Vermiculite, Zonolite Chemical Packaging Vermiculite, and Therm-O-Rock Vermiculite. This set of samples was analyzed by Lab/Cor, Inc. using TEM.

Bulk Sample Preparation and Analysis performed by the Manchester Environmental Laboratory[12]

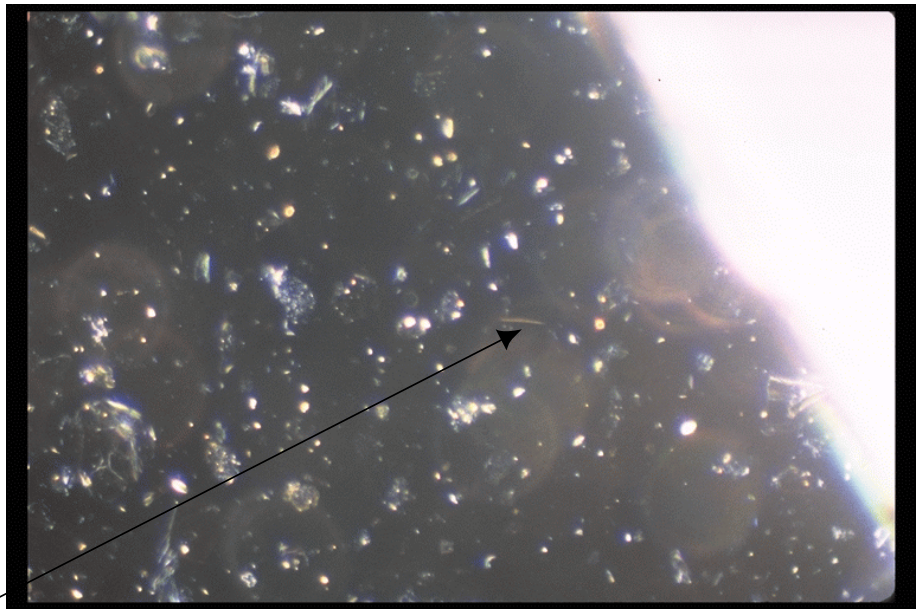
MEL analyzed bulk samples using a rinsed residue technique intended to isolate and identify asbestos in vermiculite. To prepare the rinsed residue, a 40 ml sub-sample of vermiculite was placed into a beaker. The vermiculite was rinsed with 80 ml of deionized water in an attempt to wash any loose asbestos fibers from the vermiculite matrix. After the vermiculite floated to the surface, 7 ml of water was extracted from the bottom of the beaker using a syringe and was injected into a crucible. The crucible was covered and placed in a drying oven at 68^0 centigrade for two to three days until all the water had evaporated. The residue that remained in the bottom of the crucible was then scraped out and placed onto a microscope slide and a drop of 1.605 refractive index oil was added. Any remaining residue was scraped into a small vial for possible future use.

Using a Nikon Opti-Phot Pol microscope at 400X magnification, the sample was scanned for the presence of fibers with an aspect ratio greater than five to one (5:1). Cleavage fragments were not counted as fibers because many are too small to see and positively identify using PLM. Straight, needle-like fibers that were identified as possible actinolite/tremolite fibers were checked for diagnostic optical properties such as angle of extinction, sign of elongation, and central stop dispersion staining. If asbestos was found, a determination of "PNQ" (Present Not Quantified) or “TRACE” (a trace of the subject parameter was present) was reported. Rinsed residues of positive samples were sent to Lab/Cor, Inc. for confirmation using TEM analysis.

[12] Susan E. Davis, laboratory technician - microscopist, Washington Department of Ecology



Actinolite fiber in Zonolite Chemical Packaging Vermiculite viewed by PLM[13]



Tremolite fiber in Whitney Farms Vermiculite viewed by PLM[14]

[13] Sample number 54205. Fiber is 20 to 22 microns in length

[14] Sample number 54203. Fiber is 10 to 15 microns in length

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Bulk Sample Preparation and Analysis performed by Lab/Cor, Inc.[15]

For each sample of vermiculite collected by IEU investigators, Lab/Cor, Inc. took sub-samples from at least three randomly selected areas within that sample. The sub-samples were weighed (*Raw Material Weight*) on an analytical balance (0.1 milligram sensitivity), ashed in a muffle furnace at 480^0 Centigrade to remove the organic component, and weighed again (*After Ash Weight*). After a brief dissolution of the acid soluble component in concentrated hydrochloric acid, the suspension was immediately diluted in about 20 ml of 0.2 micron (µm) - filtered deionized water, and filtered through a dry pre- weighed 0.1 micron poly-carbonate (PC) filter. After drying, the filter was weighed again (*After Hydrolysis Weight*) and processed using a preparation technique described in a draft EPA report entitled "Methodology of the Measurement of Airborne Asbestos by Electron Microscopy".[16]

The samples were coated with a thin film of carbon in a vacuum evaporator. After dissolution of the filter debris in 1-methyl-2-pyrrolidinone, the sample was placed on a 200 mesh copper TEM grid and examined under a Philips 410 transmission electron microscope equipped with energy dispersive x-ray spectroscopy (EDAX PV9800 X-ray analyzer). Samples were scanned at magnification of approximately 500X using an accelerating voltage of 100KV. The magnification was increased to 10,000X to identify any smaller asbestos fibrils (a small, slender fiber) that might be present.

TEM analysis was used for confirmation of particulate morphology as viewed at high magnification. Electron diffraction was used to identify mineral structure and energy dispersive spectroscopy (EDS) was used to provide chemical composition of particulates. After confirmation of the principal mineral type by diffraction and EDS, a visual estimate of the concentration of asbestos relative to non-asbestos was determined. Fibers of any length with an aspect ratio of at least 5:1 and proper chemistry were counted as asbestiform regulated mineral types. Cleavage fragments may have been identified as asbestiform regulated mineral fibers in this analysis.

The first PLM analysis of samples taken from bags of four products, Scotts Vermiculite, Whitney Farms Vermiculite, Zonolite Chemical Packaging Vermiculite, and Therm-O-Rock Vermiculite, revealed traces of asbestos. The initial TEM analysis of two duplicate samples obtained from a bag of Zonolite Chemical Packaging Vermiculite revealed the product contained 0.56% and 0.47% asbestos. Analysis of a sample obtained from the bag of Coles Cactus Mix contained 0.45% asbestos. The types of asbestos detected by using both PLM and TEM belong

[15] John Harris, LAB/COR, Inc., Seattle, Washington

[16] Yamate, G., S.C. Agarwall, R.D. Gibbons, ITT Research Institute, "Methodology of the Measurement of Airborne Asbestos by Electron Microscopy." Draft report, US EPA Contract 68-02-3266, July 1984

to the amphibole group and were reported specifically as either tremolite or actinolite. Copies of the results of PLM analysis of bulk samples from the MEL are included in Attachment 1. Copies of the results of TEM analysis of bulk samples by Lab/Cor, Inc. are included in Attachment 2.

The second set of samples taken from material that had settled to the bottom of the bags of Zonolite Chemical Packaging Vermiculite and Therm-O-Rock Vermiculite revealed a higher concentration of asbestos than the initial samples taken from the upper parts of the same bags. Using TEM analysis the sifted samples of Zonolite Chemical Packaging Vermiculite contained 1.88% asbestos, the sample of Therm-O-Rock Vermiculite contained 0.33% asbestos.

The rinsed residues of Zonolite Chemical Packaging Vermiculite and Therm-O-Rock Vermiculite were analyzed using both PLM and TEM. Tremolite fibers were identified by PLM, but were not quantified due to limitations of magnification. These same residues were sent to Lab/Cor, Inc. for TEM analysis. Analysis of the residue sample of Therm-O-Rock Vermiculite using TEM revealed 0.30% asbestos. Analysis of duplicate quality assurance samples of Zonolite Chemical Packaging Vermiculite using TEM revealed 0.10% and 2.79% asbestos. This illustrates the apparent variability in concentrations of asbestos that can exist in splits of the same sample.

ORIGIN OF ASBESTOS CONTAMINATED VERMICULITE PRODUCTS

Zonolite Chemical Packaging Vermiculite was produced from ore from the W.R. Grace mine in Libby, Montana, which closed in 1990.[17] Therm-O-Rock West obtains vermiculite ore from the W.R. Grace mine in Enoree, S.C., and from a mine in South Africa, and processes the ore into the finished product sold as Therm-O-Rock Vermiculite.[18] L&L Nursery Supply, Inc., which formulates Cole's Cactus Mix, uses Therm-O-Rock Vermiculite in its products that contain vermiculite.[19]

SUMMARY OF ANALYSIS OF BULK SAMPLES

Sixteen vermiculite products currently available for purchase by consumers in the Seattle metropolitan area were examined for asbestos content using two different types of microscopic analysis, PLM and TEM. Three products contained measurable amounts of asbestos using TEM analysis: Zonolite Chemical Packaging Vermiculite, Therm-O-Rock Vermiculite, and Cole's Cactus Mix. Four of the sixteen products sampled contained trace amounts of asbestos using PLM analysis: Zonolite Chemical Packaging Vermiculite, Therm-O-Rock Vermiculite, Scott's

[17] Telephone conversation with William Corcoran, W.R. Grace and Company, April 4, 2000

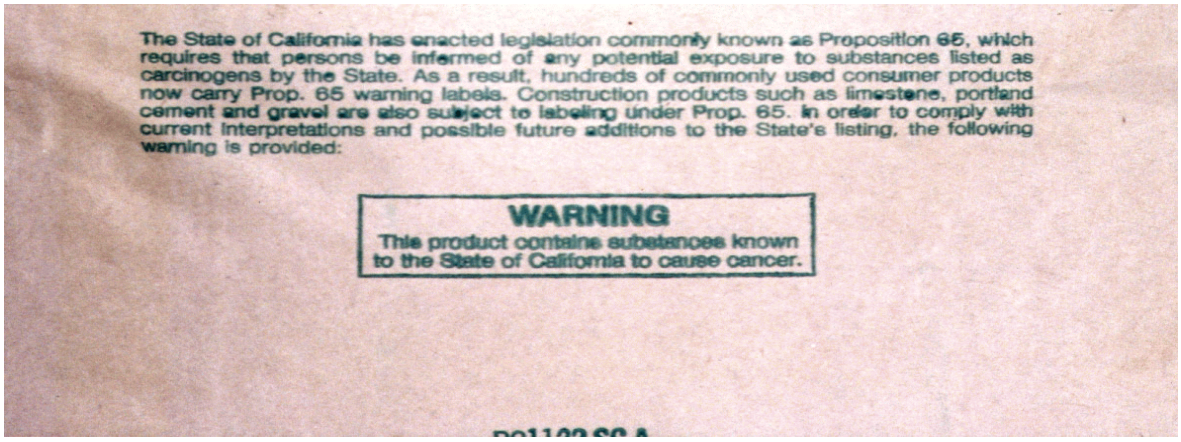
[18] Telephone conversation with Ron Dobkin, owner, Therm-O-Rock West, February 24, 2000

[19] Interview with Dan Froli, general manager, L&L Nursery Supply, Inc., Fife, WA, February 18, 2000

Vermiculite, and Whitney Farms Vermiculite. Asbestos was observed in Zonolite Chemical Packaging Vermiculite and Therm-O-Rock Vermiculite using both PLM and TEM. The analytical results for bulk samples are summarized in Table 1 on the following page.

The Region 10 investigation showed that bulk samples taken from vermiculite are not homogeneous. Concentrations of asbestos in vermiculite vary between products and within samples taken from the same product. The asbestos may also stratify and concentrate on the bottom of the bags of vermiculite during shipping, storage, and handling. Sampling methods and sample preparation can affect whether asbestos is found and what concentration is measured.

Products that contain measurable quantities of asbestos when analyzed by TEM



Warning statement on the back of a bag of Zonolite Chemical Packaging Vermiculite

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TABLE 1

PRODUCTS	SAMPLE #	PLM Group 1	PLM Group 2 Sifted Residue	TEM Group 1	TEM Group 2 Sifted	TEM Group 3 Sifted Residue
Shultz Vermiculite, 8 qt.	54202	ND		ND		
Professional Jiffy Mix Potting Soil, 8qt.	54208	ND		ND		
Sam's Choice Professional Potting Soil, 10 lb.	54209	ND		ND		
Black Gold Vermiculite, 12 qt.	54200	ND		ND		
Therm-O-Rock, 4 cubic ft.	54207	Trace	ND	ND	0.33%	0.30%
Scotts Vermiculite, 8 qt.	54204	Trace		ND		
Whitney Farms Vermiculite, 4 qt.	54203	Trace	ND	ND	ND	ND
Black Gold Seedling Mix	54216	ND		ND		
Country Cottage Professional Seed Starter, 8 qt.	54215	ND		ND		
Zonolite Chemical Packaging Vermiculite, 19 lb.	54205 54206- QA	Trace Trace	PNQ	0.56% 0.47%	1.88%	0.10% 2.79%
Scotts Progro Professional Potting Mix, 25 qt.	54217	ND		ND		ND
Coles Vermiculite	54201	ND		ND		
Coles African Violet Mix, 4 qt.	54213	ND		ND		
Coles Cactus Mix, 4 qt.	54214	ND		0.45%		
Coles Lighthouse Plant Mix, 8 qt.	54210	ND		ND		
Schultz Seed Starter	54211 54212- QA	PNQ ND		ND ND		
Zonolite (bag #2)	104200		ND		ND	

ND none detected
PNQ present but not quantified
QA quality assurance

PHASE III

Once the analysis of bulk samples identified which vermiculite products contained asbestos, the next step was to determine if the asbestos in the vermiculite could become airborne during use and present a potential exposure hazard for individuals who work with the asbestos-contaminated vermiculite. Multiple tests were conducted using the three vermiculite products that had been found to contain measurable quantities of asbestos as determined by TEM analysis. Each product was subjected to simulated use that was typical of how a consumer might handle the product. Air monitoring samples were taken during the simulations.

All analytical data presented in the air monitoring section of this report was generated by Lab/Cor, Inc., which is accredited through the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the Department of Commerce under the National Institute of Standards and Technology (NIST).[20] NVLAP accreditation certifies that the laboratory has met an established level of competence. It does not guarantee the accuracy of the analytical results.

COLLECTION OF AIR MONITORING SAMPLES

To determine what activities would be simulated, IEU investigators considered information provided by citizens reporting how they used various products, the purpose for which the product was intended, and a study conducted by the W.R. Grace and Company that was provided to the Consumer Product Safety Commission on April 1, 1980.[21] A copy of the letter from E. S. Wood, Executive Vice President of W. R. Grace & Co. Industrial Chemicals Group to the United States Consumer Product Safety Commission with attached report entitled User Exposure to Fibrous Tremolite in Vermiculite Consumer Products dated April 1, 1980 is included in Attachment 3.

There are several protocols that can be used for analyzing air samples to determine the number of asbestos fibers present in a volume of air. IEU investigators conducted a literature search to become familiar with various analytical methods. The final decision on what methodologies to use for analysis of air samples taken during Phase III was based on consultation with an industrial hygienist from the Washington State Department of Labor and Industries, Region 10 quality assurance staff, and the analysts at Lab/Cor, Inc.

[20] NVLAP criteria are published in the Code of Federal Regulations (CFR, Title 15, Part 285)

[21] Letter from E. S. Wood, Executive Vice President of W. R. Grace & Co. Industrial Chemicals Group to the United States Consumer Product Safety Commission with attached report entitled User Exposure to Fibrous Tremolite in Vermiculite Consumer Products dated April 1, 1980

The primary method selected for analyzing air monitoring samples taken during Phase III is the National Institute of Occupational Safety and Health (NIOSH) method 7402[22] which is used to determine levels of asbestos in ambient air in the workplace. For comparison, a second method was selected which is used to monitor levels of asbestos in schools under the Asbestos Hazards Emergency Response Act (AHERA). The AHERA method[23] is described in the Code of Federal Regulations (CFR). Both methods are used to analyze for asbestos fibers or structures that become captured in air filters that are connected to air monitoring pumps. The air monitoring is conducted for a set period of time while pumps draw a predetermined volume of air through the filters. After successful sampling and analysis, the number of fibers per cubic centimeter of air can be determined. A comparison of the two methods is shown in Table 2.

TABLE 2

Comparison of NIOSH method 7402 and AHERA method.

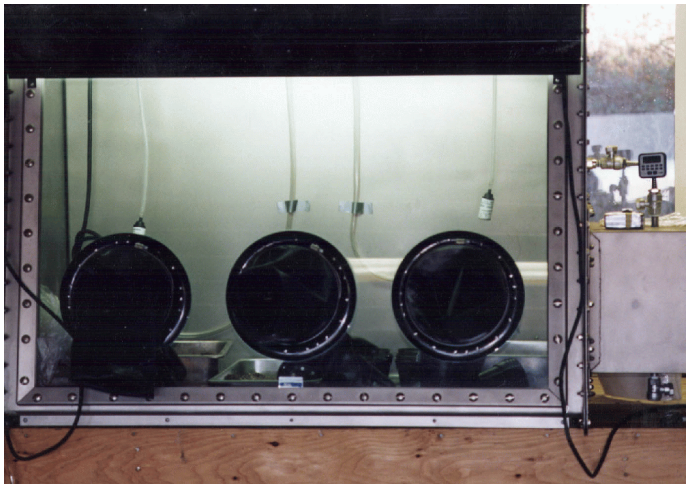
Method	Filter Size	Volume of Air	Counting Rules
NIOSH 7402	0.45 to 1.2 µm	0.5 to 16 liters per minute	> 5.0 µm in length ≥ 3:1 aspect ratio
AHERA	≤ 0.45 µm	≥1 liter per minute	≥ 0.5 µm in length ≥ 5:1 aspect ratio

In Phase III IEU investigators simulated the use of Coles Cactus Mix as a potting soil, the use of Zonolite Chemical Packaging Vermiculite and Therm-O-Rock Vermiculite in preparation of a potting soil, and the use of Zonolite Chemical Packaging Vermiculite in packing laboratory samples. The Zonolite Chemical Packaging Vermiculite was tested as a component of potting soil because EPA observed this product being sold at two Seattle area stores that sell retail garden supplies.

The simulated use of vermiculite products was conducted in a work space inside a stainless steel Kewaunee Scientific Equipment (KSE) glove box. The workplace dimensions were approximately 4 feet long by 3 feet high with a depth of 21 inches at the top and 27 inches at the bottom. The glove box is equipped with a front glass viewing panel and fluorescent lighting allowing observation of the work area.

[22] Asbestos by TEM, NIOSH Manual of Analytical Methods, Fourth Edition, 8/15/94

[23] Asbestos-Containing Materials in Schools, 40 CFR Part 763, sub-part E



Kewaunee Scientific Equipment glove box equipped with air-monitoring cassettes

The product use simulations and air sampling took place between February 15, 2000, and April 14, 2000. In some of the product use simulations the air filters became overloaded with dust and particulate matter during air monitoring. Because of this overloading, the analytical methods used for samples collected under the NIOSH 7402 and AHERA protocols had to be modified to include indirect sample preparation as outlined in the "Methodology of the Measurement of Airborne Asbestos by Electron Microscopy."[24]

This modification has the potential to disrupt and fragment fibers, possibly resulting in a higher number of structures or fibers per cubic centimeter than were originally present. It was understood that the indirect sample preparation could affect the fiber count. However, during the initial stages of the investigation, it was essential to determine whether asbestos had been released into the air. Precise quantification would be determined later through adjustment of the duration of sampling and the flow rate of the air monitoring equipment.

During project simulations based on the NIOSH method 7402 protocol, the ambient air over the work space was monitored with two calibrated Gilian Hi Flow pumps attached with Tygon tubing to 25 mm Zefon air monitoring cassettes with 0.8 µm mixed cellulose ester (MCE) filters. The air monitoring cassettes were suspended inside the glove box approximately 18 inches above the surface of the work area to simulate the breathing zone of an average person. Air samples were collected during simulations at durations between 15 and 30 minutes, with the pumps set to draw approximately 1 to 3 liters of air per minute. The different durations and flow

[24] See footnote 16

rates are allowed by the NIOSH method 7402 to provide optimum loading of the filter cassettes. To adjust the sampling duration, some of the air filters used during monitoring at the different durations and flow rates were viewed under PLM to determine if the filters were overloaded.

For tests using the AHERA protocol, the ambient air inside the glove box was monitored using two calibrated Allegro Industries High Volume Sampling Pumps attached with Tygon tubing to 25 mm Zefon air monitoring cassettes with 0.45 µm MCE filters. Air samples were collected during simulations for 100-minute durations with the pumps set to draw approximately 11 liters of air per minute.

Pumps were calibrated with either a Gilian "Buck" Calibrator or a Gilian "Gilibrator" calibration device. The flow rate for each pump was recorded before and after each sample was collected. The average of before and after values reported to the laboratory was written on the labels placed on the air monitoring cassettes and documented on the chain of custody forms.

Prior to conducting project simulations, a work space background sample was collected between testing of each different product to determine if the work area was contaminated with particulate or asbestos fibers from the previous test. Also, quality control samples of the air monitoring cassettes and field blanks taken outside the glove box were obtained for quality assurance. A high efficiency particulate arrestance (HEPA) vacuum and damp cloth was used to clean the work space in the glove box between tests to remove any possible asbestos fibers between tests involving different products.

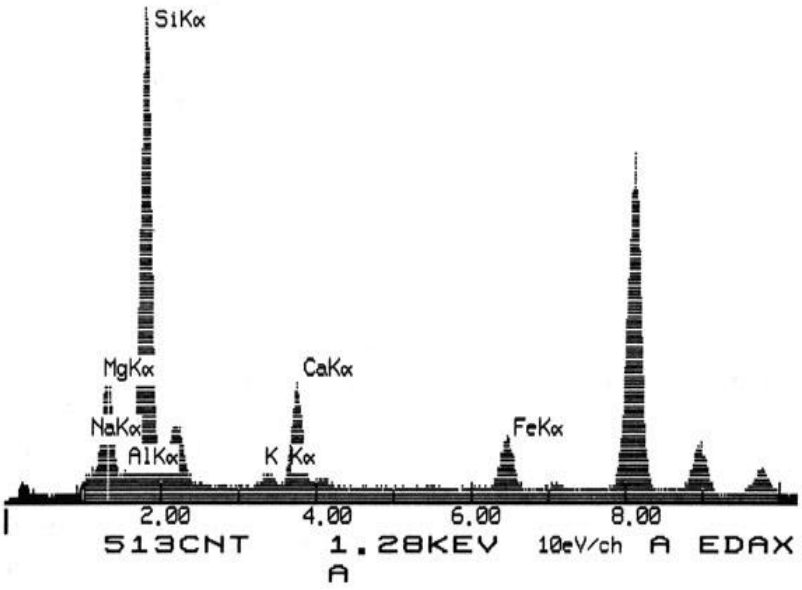
The activity that simulated potting plants involved emptying a container of soil into a plastic tub and manipulating the soil to break up clods. The soil was placed in 10 plastic 4- inch pots at several intervals. Next the pots were emptied back into the plastic tub and the work space was cleaned by sweeping loose spilled soil into a pre-cleaned dust pan and placing it back into the plastic tub. This simulation was run three times for 30 minutes and once for 100 minutes.

To simulate the preparation of potting soil, IEU investigators mixed 50% vermiculite and 50% peat moss. Bulk samples of the peat moss were analyzed and determined not to contain detectable asbestos fibers. The remainder of this simulation was similar to the previous simulation of potting plants. This simulation was run two times for 30 minutes and once for 100 minutes using the Zonolite Chemical Packaging Vermiculite, and three times for 15 minutes using Therm-O-Rock Vermiculite.

Vermiculite is used by laboratories around the country to pack chemicals and hazardous material samples for shipping. The vermiculite cushions jars to keep them from breaking and absorbs spillage if the containers leak during shipping. To simulate packing laboratory samples, four 8-ounce glass jars were placed into a stainless steel pan and covered with vermiculite. This simulation was repeated for durations of 30, 20, and 15 minutes.

Sample preparation and Analysis performed by Lab/Cor, Inc.[25]

For the NIOSH method 7402 using TEM, samples were collapsed with acetone, and etched in a low temperature plasma etcher to remove the top surface of the filter and other organics. The samples were coated at high vacuum with a thin layer of carbon, placed on 200 mesh copper grids and allowed to dissolve in acetone until cleared of filter debris. The 200 mesh copper TEM grids were examined under a Philips 410 transmission electron microscope equipped with EDS. Air samples were scanned at magnification of approximately 990X using an accelerating voltage of 100KV. The magnification was increased to 10,000X for structure sizing. The NIOSH method 7402 counts structures or fibers if they are greater than 0.25 µm in diameter with a minimum aspect (length to width) ratio of 3:1 and a length greater than 5.0 µm.



EDS Spectra used to verify the elemental composition of an actinolite fiber collected during simulated use of Zonolite Chemical Packaging Vermiculite

An indirect analytical technique was applied to overloaded samples collected using NIOSH and AHERA protocols. The analysis was conducted in accordance with the draft method done under contract 68-02-3266 for EPA, July 1984 entitled "Methodology of the Measurement of Airborne Asbestos by Electron Microscopy."[26]

[25] John Harris, LAB/COR, Inc., Seattle, Washington

[26] See footnote 16

The sample filters were removed from sampling cassettes and placed into clean sonication dishes. After washing out each cassette cowl with particle-free, deionized water, the supernatant fluid was combined with each filter, placed in a sonication dish, and gently sonicated to release the particulate from the filter. After brief sonication, aliquots were drawn from the supernate and filtered onto 0.22 µm MCE filters. Samples were coated at high vacuum with a thin layer of carbon, placed on 200 mesh copper grids, and allowed to dissolve in acetone until cleared of filter debris. The 200 mesh copper TEM grids were examined under a Philips 410 transmission electron microscope equipped with EDS. Air samples were analyzed at a screen magnification of approximately 17,621X using an accelerating voltage of 100KV. The sizing of grid openings was performed on the microscope at a magnification of approximately 550X. Counting rules for the draft method were modified to match the AHERA counting rules more closely. This method allows structures greater than 0.5 µm in length with substantial parallel sides and an aspect ratio of 5:1 to be counted.

Before any air monitoring samples were taken using vermiculite products, quality assurance, quality control and work area background samples were collected and analyzed. None of these samples showed the presence of asbestos. This was an important part of the air monitoring procedure because it showed the work area and the filters used were free of asbestos to begin with, and there no cross contamination of the work area occurred when switching from one product to another.

No asbestos fibers were detected when air samples collected during the simulated use of Coles Cactus Mix and Therm-O-Rock Vermiculite were analyzed. Using the indirect method of analysis, asbestos was detected in air samples collected when Zonolite Chemical Packaging Vermiculite was used to simulate the preparation and use of potting soil and for sample packing.

Subsequent air monitoring samples were taken when Zonolite Chemical Packaging Vermiculite was used to simulate packing samples. The flow rates and sample times were reduced to avoid overloading the filters and allow for direct analysis under the NIOSH 7402 protocol. These air samples were run for 15 to 20 minutes at flow rates of 1 to 2 liters per minute and were repeated four times. The results of analysis ranged from 0.16 to 0.95 asbestos fibers per cubic centimeter of air. Complete results and supporting data for the air monitoring portion of this project are included in Attachment 4.

REGION 10 INVESTIGATION OF ASBESTOS IN VERMICULITE

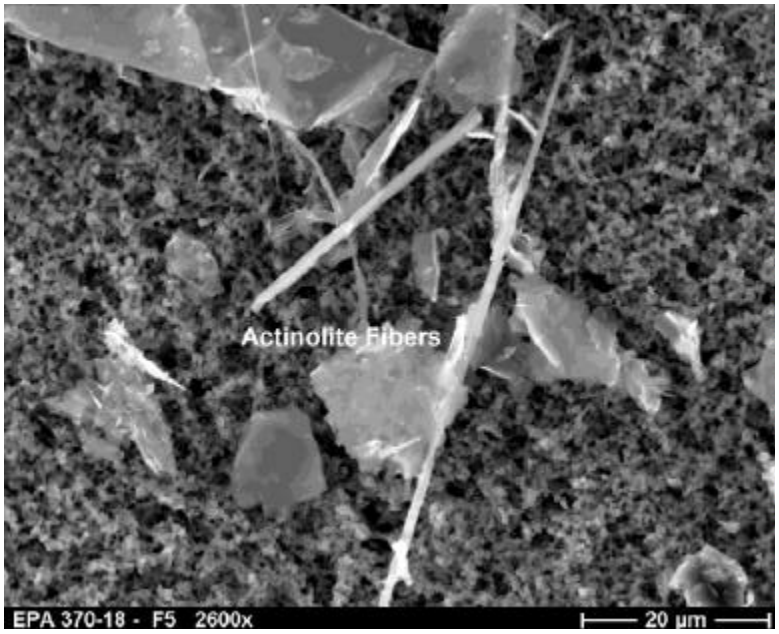
SUMMARY OF ANALYSIS OF AIR MONITORING SAMPLES

Three products were subjected to air monitoring during simulated use in a confined area. Two of the products, Cole's Cactus Mix and Therm-O-Rock Vermiculite, did not release airborne asbestos fibers during simulated use. The third product, Zonolite Chemical Packaging Vermiculite, did release airborne asbestos fibers during simulated use and therefore presents a potential for exposure to asbestos. Tables 3 and 4 summarize the results of analyses of air monitoring samples taken while simulating use of Zonolite Chemical Packaging Vermiculite in preparing and using potting soil and for packing samples.

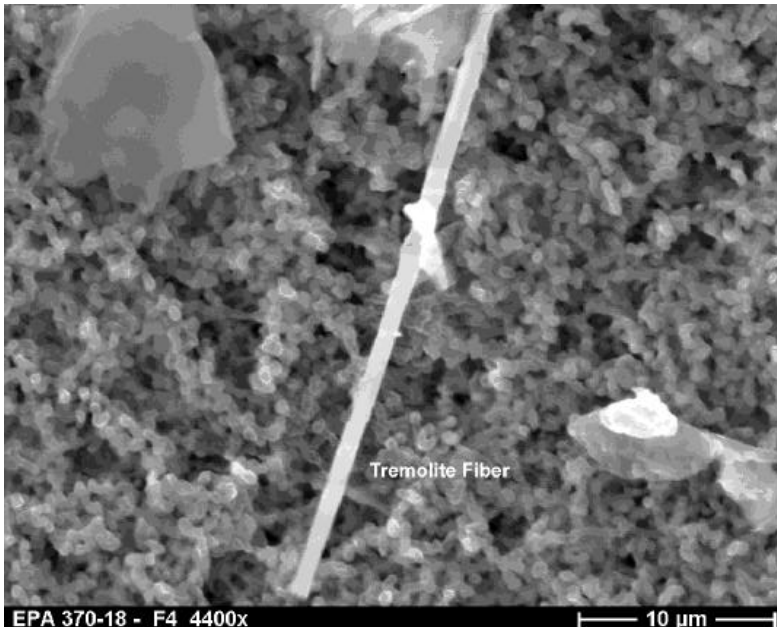
Because of this potential for exposure to asbestos, EPA Region 10 advised consumers not to use Zonolite Chemical Packaging Vermiculite until further statistically based testing could be performed. EPA Region 10 also advised consumers to follow three basic precautions when working with products that contain vermiculite in order to reduce potential exposure to asbestos: 1) use vermiculite outdoors; 2) keep vermiculite damp to avoid generating dust; 3) avoid bringing dust from clothing into the home.

CONCLUSIONS

- Five vermiculite products tested during the Region 10 investigation contained asbestos.
- One asbestos-contaminated vermiculite product tested by Region 10 released airborne asbestos fibers when subjected to simulated use.
- Consumers have no way of knowing which vermiculite products are contaminated with asbestos and which are not.
- Analysis of asbestos-contaminated vermiculite products revealed a wide degree of variability in the amount and types of asbestos present in the samples.
- The variability of analytical results demonstrates a need for additional statistically based studies using more sensitive sampling and analytical methods.



Actinolite fibers in Zonolite Chemical Packaging Vermiculite viewed by SEM[27]



Tremolite fiber in Zonolite Chemical Packaging Vermiculite viewed by SEM

[27] Scanning electron microscope

REGION 10 INVESTIGATION OF ASBESTOS IN VERMICULITE

TABLE 3

ANALYTICAL METHOD: **Methodology of the Measurement of Airborne Asbestos by Electron Microscopy. (draft method)**

PRODUCT: **Zonolite Chemical Packaging Vermiculite**

Sample #	Date	Description	Results of Analysis
		Potting Soil Preparation - AHERA Protocol	
74216	2/16/2000	Pump #3, 11.0 liters/minute for 100 minutes, Indirect analysis.	0.847 structures per cc
74217	2/16/2000	Pump #4, 11.0 liters/minute for 100 minutes, Indirect analysis.	0.564 structures per cc
		Potting Soil Prep - NIOSH 7402 Protocol	
104201	3/7/2000	Pump #1, 2.8 liters/minute for 30 minutes, Indirect analysis	0.202 structures per cc
104202	3/7/2000	Pump #5, 2.8 liters/minute for 30 minutes, Indirect analysis	0.373 structures per cc
104205	3/7/2000	Pump #1, 2.8 liters/minute for 30 minutes, Indirect analysis	0.380 structures per cc
104206	3/7/2000	Pump #5, 2.8 liters/minute for 30 minutes, Indirect analysis	0.080 structures per cc
		Sample Packaging Simulation - NIOSH 7402 Protocol	
104209	3/8/2000	Pump #1, 2.9 liters/minute for 30 minutes, Indirect analysis	6.960 structures per cc
104210	3/8/2000	Pump #5, 2.9 liters/minute for 30 minutes, Indirect analysis	8.170 structures per cc

cc = cubic centimeter

REGION 10 INVESTIGATION OF ASBESTOS IN VERMICULITE

TABLE 4

ANALYTICAL METHOD: **NIOSH 7402**

PRODUCT: **Zonolite Chemical Packaging Vermiculite**

Sample #	Date	Description	Results of Analysis
		Sample Packing Simulation	
154000	4/11/2000	Pump #5, 2.0 liters/minute for 20 minutes, direct analysis.	0.344 fibers per cc
154001	4/11/2000	Pump #1, 1.5 liters/minute for 20 minutes, direct analysis	0.352 fibers per cc
154002	4/11/2000	Pump #1, 1.5 liters/minute for 15 minutes, direct analysis	0.342 fibers per cc
154003	4/11/2000	Pump #5, 2.0 liters/minute for 15 minutes, direct analysis	0.160 fibers per cc
154008	4/13/2000	Pump #1, 1.0 liters/minute for 15 minutes, direct analysis	0.702 fibers per cc
154009	4/13/2000	Pump #5, 1.0 liters/minute for 15 minutes, direct analysis	0.477 fibers per cc
154010	4/13/2000	Pump #1, 1.0 liters/minute for 15 minutes, direct analysis	0.249 fibers per cc
154011	4/13/2000	Pump #5, 1.0 liters/minute for 15 minutes, direct analysis	0.948 fibers per cc

cc = cubic centimeter

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11) U.S. Geological Survey, (1990), Vermiculite Minerals Yearbook, Potter, Michael J.

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Appendix 1

Summary of Interviews

A registered nurse from Tennessee said vermiculite is used routinely in southern states as an underlayment for swimming pools. She recently watched a crew install a pool in her backyard, and noticed they were coated with vermiculite dust. None of the workers wore respiratory protection. The dust drifted into her home and got onto her furniture. She said she intended to take samples of the dust, and had already purchased a HEPA filtered vacuum cleaner to eliminate dust that might be contaminated with asbestos.

A technician from a local children's hospital was has used vermiculite for years to make orthotics and prosthetic devices. She was concerned because the material safety data sheet from the manufacturer clearly stated the vermiculite came from the W.R. Grace and Company mine in Libby, Montana. The technician surmised that asbestos from the Libby vermiculite could have contaminated the work area where children are fitted for prosthetics and where employees spend much of their time working.

A laboratory assistant from a local community college said she routinely unpacks chemicals that arrive packed in vermiculite. This vermiculite is then saved in large bins for use in the school's greenhouses. She was concerned that young college-age students could be exposed to asbestos from vermiculite both in the laboratory and in greenhouses.

The owner of a preschool in Michigan called to ask for guidance in sampling vermiculite attic insulation. The caller said he and his wife had operated a preschool out of the building for twenty years, and he was upset to learn that young children attending his school might have been exposed to asbestos in the vermiculite. He subsequently took samples of the insulation and reported asbestos ranging from non-detect to 4% by weight using TEM analysis.

An employee from the EPA Region 10 laboratory reported that samples of hazardous materials and new chemicals arrive at the lab packed in vermiculite. He was worried that employees at the lab could be exposed to asbestos while unpacking samples and chemicals. The Region 10 lab subsequently decided to use alternative packaging materials when shipping, and to specify that incoming shipments not be packed in vermiculite.

An industrial hygienist with a city park district said the district uses large quantities of vermiculite in greenhouses. He said he intended to take air monitoring samples while greenhouse workers were using vermiculite to see if there was any measurable exposure to asbestos.

REGION 10 INVESTIGATION OF ASBESTOS IN VERMICULITE

Two men who formerly worked in vermiculite exfoliation plants in the northwest called to provide details about the manufacturing process. One said he suffers significant impaired lung function and has been diagnosed with asbestosis. The other provided a report of a recent chest x-ray showing early signs of asbestos related disease.

An employee of a large manufacturing facility in the Seattle area reported the company made a decision around 1980 to stop accepting supplies or equipment shipped in vermiculite because of the likelihood that the vermiculite was contaminated with asbestos. The company decided vermiculite presented a health hazard to employees and was a "right to know" issue.

The EPA National Enforcement Investigations Center laboratory stopped using vermiculite to ship hazardous materials nearly twenty years ago in part because of the potential for asbestos contamination in vermiculite. Lab personnel were also concerned about the potential for vermiculite to aerosolize and spread contaminants into the air.

A large military facility in the Seattle area reported using vermiculite for many years to pack hazardous materials for shipment. Because of concern the employees may have been exposed to asbestos when handling vermiculite, the employees of the shipping department were enrolled in the medical monitoring program.

Two different contractors at a nuclear facility in the northwest reported using large quantities of vermiculite in handling and shipping hazardous materials. Industrial hygienists from both companies are conducting their own inquiries to determine if employees who work with vermiculite have been or are being exposed to asbestos.

A resident of Libby, Montana, learned that Region 10 was investigating asbestos contamination in vermiculite. On a trip to Seattle he brought samples of rocks from the mine to for Region 10 scientists to analyze. His father and two brothers had worked at the mine, he had not. His father died of asbestosis. His two brothers have both been diagnosed with asbestosis. Analysis of the rock sample by the Manchester Environmental Laboratory using PLM showed the sample was 80% tremolite asbestos by weight.[28] A copy of the results of analysis follow this appendix.

[28] MEL sample analysis report for sample identified as Libby #1 collected 5/17/00

5/31/00
13:26:47

Manchester Environmental Laboratory
Report by Parameter for Project ATD-276A

Project Code:	ATD-276A	Collected:	5/17/00
Project Name:	VERMICULITE MINES	Matrix:	Solid
Project Officer:	KATHY JOHNSON	Sample Number:	00210760
Account Code:	0001B10P90102E	Type:	Reg sample
Station Description:	LIBBY #1		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			UND
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite	80	%	

Attachment 1

Remark Codes
for
Manchester Environmental Laboratory Generated Data

ASBESTOS ANALYSIS

Remark Codes		Definition
PNQ	–	The subject parameter was present in the sample but no quantifiable result was determined.
UND	–	The subject parameter was analyzed for but was undetected.
TRACE	–	A trace of the subject parameter was present.
NAF	–	The subject parameter was not analyzed for.

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054200
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	BLACK GOLD VERMICULITE 12QT		

GEN

Parameter : Bulk Asbestos Analysis
Method :
Prep Method:

		Result	Units	Qlfr
Analytes :	*200009 Actinolite			UND
	*200006 Amosite			UND
	*200007 Anthophyllite			UND
	*200013 Cellulose			PNQ
	*200005 Chrysotile			UND
	*200010 Crocidolite			UND
	*200011 Glass Fiber			PNQ
	*200012 Mineral Wool			UND
	*200008 Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054201
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	COLES VERMICULITE 12QT		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			PNQ
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054202
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	SCHULTZ VERMICULITE 8QT		

GEN

Parameter : Bulk Asbestos Analysis
Method :
Prep Method:

		Result	Units	Qlfr
Analytes : *200009	Actinolite			UND
*200006	Amosite			UND
*200007	Anthophyllite			UND
*200013	Cellulose			PNQ
*200005	Chrysotile			UND
*200010	Crocidolite			UND
*200011	Glass Fiber			UND
*200012	Mineral Wool			UND
*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054203
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	WHITNEY FARMS VERMICULITE 4QT		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			UND
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			TRACE

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054204
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	SCOTTS VERMICULITE QT		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			UND
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			TRACE

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054205
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	ZONOLITE VERMICULITE 19LB		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			UND
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			TRACE

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	**Collected:**	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	**Matrix:**	Solid
Project Officer:	JED JANUCH	**Sample Number:**	00054206
Account Code:	0001B10P40101C	**Type:**	Reg sample
Station Description:	ZONOLITE VERMICULITE 19LB		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			UND
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			TRACE

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054207
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	THERMO ROCK 4 CUBIC FT		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			UND
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			TRACE

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054208
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	PROF. JIFFY MIX 8QT		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			PNQ
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054209
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	SAMS COICE POTTING SOIL 10LB		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			UND
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054210
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	COLES HOUSE PLANT MIX 8QT		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			PNQ
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054211
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	SCHULTZ SEED STARTER 5.4 LB		

GEN

Parameter : Bulk Asbestos Analysis
Method :
Prep Method:

Analytes :		Result	Units	Qlfr
*200009	Actinolite			PNQ
*200006	Amosite			UND
*200007	Anthophyllite			UND
*200013	Cellulose			UND
*200005	Chrysotile			UND
*200010	Crocidolite			UND
*200011	Glass Fiber			UND
*200012	Mineral Wool			UND
*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054212
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	SCHULTZ SEED STARTER 5.4 LB		

GEN

Parameter : Bulk Asbestos Analysis
Method :
Prep Method:

		Result	Units	Qlfr
Analytes : *200009	Actinolite			UND
*200006	Amosite			UND
*200007	Anthophyllite			UND
*200013	Cellulose			PNQ
*200005	Chrysotile			UND
*200010	Crocidolite			UND
*200011	Glass Fiber			UND
*200012	Mineral Wool			UND
*200008	Tremolite			UND

5-5.00

9:59:37

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054213
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	COLES AFRICAN VIOLOET MIX 4 QT		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			PNQ
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054214
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	COLES CACTUS MIX 4QT		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			PNQ
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054215
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	COUNTRY COTTAGE SEED STARTER 8QT		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			PNQ
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	**Collected:**	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	**Matrix:**	Solid
Project Officer:	JED JANUCH	**Sample Number:**	00054216
Account Code:	0001B10P40101C	**Type:**	Reg sample
Station Description:	BLANK GOLD SEEDLING MIX 16QT		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			PNQ
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	**Collected:**	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	**Matrix:**	Solid
Project Officer:	JED JANUCH	**Sample Number:**	00054217
Account Code:	0001B10P40101C	**Type:**	Reg sample
Station Description:	SCOTTS PROGRO 25QT		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			PNQ
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code: ESD-045A
Project Name: RETAIL HOME & GARDEN CENTERS
Project Officer: JED JANUCH
Account Code: 0001B10P40101C
Station Description: WHITNEY FARMS VERMICULITE - FRED MEYER

Collected: 1/31/00
Matrix: Solid
Sample Number: 00054218
Type: Reg sample

GEN

Parameter : Bulk Asbestos Analysis
Method :
Prep Method:

Analytes		Result	Units	Qlfr
*200009	Actinolite			UND
*200006	Amosite			UND
*200007	Anthophyllite			UND
*200013	Cellulose			UND
*200005	Chrysotile			UND
*200010	Crocidolite			UND
*200011	Glass Fiber			UND
*200012	Mineral Wool			UND
*200008	Tremolite			UND

Manchester Environmental Laboratory

Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054219
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	ZONOLITE - BURDIC FEED		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			UND
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			UND
	*200012	Mineral Wool			UND
	*200008	Tremolite			PNQ

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	Collected:	1/31/00
Project Name:	RETAIL HOME & GARDEN CENTERS	Matrix:	Solid
Project Officer:	JED JANUCH	Sample Number:	00054220
Account Code:	0001B10P40101C	Type:	Reg sample
Station Description:	THERMO ROCK CARPINITO BROS		

			Result	Units	Qlfr
GEN					
Parameter	: Bulk Asbestos Analysis				
Method	:				
Prep Method	:				
Analytes	: *200009	Actinolite			UND
	*200006	Amosite			UND
	*200007	Anthophyllite			UND
	*200013	Cellulose			UND
	*200005	Chrysotile			UND
	*200010	Crocidolite			UND
	*200011	Glass Fiber			PNQ
	*200012	Mineral Wool			UND
	*200008	Tremolite			UND

Manchester Environmental Laboratory
Combined Final Report for Project ESD-045A

Project Code:	ESD-045A	**Collected:**	3/ 7/00
Project Name:	RETAIL HOME & GARDEN CENTERS	**Matrix:**	Solid
Project Officer:	JED JANUCH	**Sample Number:**	00104200
Account Code:	0001B10P40101C	**Type:**	Reg sample
Station Description:	ZONOLITE - CHUBBY & TUBBY		

GEN

Parameter : Bulk Asbestos Analysis
Method :
Prep Method:

Analytes :		**Result**	**Units**	**Qlfr**
*200009	Actinolite			UND
*200006	Amosite			UND
*200007	Anthophyllite			UND
*200013	Cellulose			PNQ
*200005	Chrysotile			UND
*200010	Crocidolite			UND
*200011	Glass Fiber			UND
*200012	Mineral Wool			UND
*200008	Tremolite			UND

Attachment 2

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000109

Report Date: May 25, 2000

Client Information	
Project Name:	Retail Home and Garden Centers
Project No.:	ESD-045 A
P. O. No.:	0Y0107NASX

Tracking Information		
Login:	Feb 3, 2000	*By:* DJ
Reviewed:	Feb 11, 2000	*By:* JH
Final Review:	May 25, 2000	*By:* TMM

Analysis Information	
Sample Type:	Bulk
Analysis Type:	Semi-Quantitative
Reference No.:	EPA/600/R-93/116 68-02-3266

FINAL TABLE

Transmission Electron Microscopy – Semi-Quantitative – Bulk Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Regulated Asbestiform Mineral Type	Weight Percent	Other Components	Weight Percent	Prepped By	Prep Date(s)	Analyst	Analysis Date
000109-01	54200	Black Gold Vermiculite / 12 Qt. / Carpinito Bros.	None Detected		Organics Acid Solubles Other Nonasbestos	25.00 40.58 34.42	DW DW	02/04/00 02/07/00	GG	02/08/00
000109-02	54201	Cole's Vermiculite / 12 Qt./ Eagles (Lowes)	None Detected		Organics Acid Solubles Other Nonasbestos	1.32 47.53 51.15	DW DW	02/04/00 02/07/00	GG	02/09/00
000109-03	54202	Scholtz Vermiculite / 8 Qt./ Wallmart	None Detected		Organics Acid Solubles Other Nonasbestos	0.00 46.84 53.16	DW DW	02/04/00 02/07/00	GG	02/08/00
000109-04	54203	Whitney Farms / 14 Qt./ Fred Meyers	None Detected		Organics Acid Solubles Other Nonasbestos	0.68 45.27 54.05	DW DW	02/04/00 02/07/00	GG	02/08/00
000109-05	54204	Scotts Vermiculite / 8 Qt./ Wallmart	None Detected		Organics Acid Solubles Other Nonasbestos	0.19 84.45 15.36	DW DW	02/04/00 02/07/00	GG	02/09/00
000109-06	54205	Zonolite Vermiculite / 19 Lb./ Burdie Feeds Inc.	Actinolite	0.56	Organics Acid Solubles Other Nonasbestos	1.46 42.98 55.00	DW DW	02/04/00 02/07/00	GG	02/09/00
000109-07	54206	Zonolite Vermiculite / 19 Lb./ Burdie Feeds Inc.	Actinolite	0.47	Organics Acid Solubles Other Nonasbestos	2.05 51.17 46.31	DW DW	02/04/00 02/07/00	GG	02/09/00
000109-08	54207	Therm-ORock Verm /4 Cu. Ft./ Carpinito Bros.	None Detected		Organics Acid Solubles Other Nonasbestos	5.49 60.14 34.37	DW DW	02/04/00 02/07/00	GG	02/09/00
000109-09	54208	Prf. Jiffy Mix / 8 Qt./ Wallmart	None Detected		Organics Acid Solubles Other Nonasbestos	51.40 27.54 21.06	DW DW	02/04/00 02/07/00	GG	02/08/00

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000109

Report Date: May 25, 2000

Client Information	
Project Name:	Retail Home and Garden Centers
Project No.:	ESD-045 A
P. O. No.:	0Y0107NASX

Tracking Information			
Login:	Feb 3, 2000	*By:*	DJ
Reviewed:	Feb 11, 2000	*By:*	JH
Final Review:	May 25, 2000	*By:*	TMM

Analysis Information	
Sample Type:	Bulk
Analysis Type:	Semi-Quantitative
Reference No.:	EPA/600/R-93/116 68-02-3266

FINAL TABLE

Transmission Electron Microscopy – Semi-Quantitative – Bulk Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Regulated Asbestiform Mineral Type	Weight Percent	Other Components	Weight Percent	Prepped By	Prep Date(s)	Analyst	Analysis Date
000109-10	54209	Sams Choice Prf Potting Mix / 10 Lb./ Wallmart	None Detected		Organics Acid Solubles Other Nonasbestos	34.06 21.69 44.25	DW DW	02/04/00 02/07/00	GG	02/09/00
000109-11	54210	Coles light House Plant Mix / 8 Qt./ Eagle	None Detected		Organics Acid Solubles Other Nonasbestos	36.12 23.70 40.18	DW DW	02/04/00 02/07/00	GG	02/09/00
000109-12	54211	Schultz Seed Starter / 5.4 Lb./ Eagles	None Detected		Organics Acid Solubles Other Nonasbestos	43.30 43.02 13.68	DW DW	02/04/00 02/07/00	GG	02/09/00
000109-13	54212	Schultz Seed Starter / 5.4 Lb./ Eagles	None Detected		Organics Acid Solubles Other Nonasbestos	28.57 45.90 25.53	DW DW	02/04/00 02/07/00	GG	02/10/00
000109-14	54213	Coles African Violet Mix / 4 Qt./ Eagles	None Detected		Organics Acid Solubles Other Nonasbestos	44.59 13.51 41.90	DW DW	02/04/00 02/07/00	GG	02/10/00
000109-15	54214	Coles Cactus Mix / 4 Qt./ Eagles	Actinolite	0.45	Organics Acid Solubles Other Nonasbestos	17.42 37.64 44.49	DW DW	02/04/00 02/07/00	GG	02/07/00
000109-16	54215	Country Cottage Prf. Seed Starter / 8 Qt./ Oriental Garden Center	None Detected		Organics Acid Solubles Other Nonasbestos	44.94 23.42 31.64	DW DW	02/04/00 02/07/00	GG	02/07/00
000109-17	54216	Black Gold seedling Mix / 16 Qt./ Fred Meyers	None Detected		Organics Acid Solubles Other Nonasbestos	65.54 11.49 22.97	DW DW	02/04/00 02/07/00	GG	02/10/00
000109-18	54217	Scotts Pro Grow Professional Potting Mix / 25 Qt./ Home Depot	None Detected		Organics Acid Solubles Other Nonasbestos	49.12 38.35 12.53	DW DW	02/04/00 02/07/00	GG	02/07/00

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000109

Report Date: May 25, 2000

Client Information	
Project Name:	Retail Home and Garden Centers
Project No.:	ESD-045 A
P. O. No.:	0Y0107NASX

Tracking Information		
Login:	Feb 3, 2000	*By:* DJ
Reviewed:	Feb 11, 2000	*By:* JH
Final Review:	May 25, 2000	*By:* TMM

Analysis Information	
Sample Type:	Bulk
Analysis Type:	Semi-Quantitative
Reference No.:	EPA/600/R-93/116 68-02-3266

FINAL TABLE

Transmission Electron Microscopy – Semi-Quantitative – Bulk Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Regulated Asbestiform Mineral Type	Weight Percent	Other Components	Weight Percent	Prepped By	Prep Date(s)	Analyst	Analysis Date
000109-19	00054205A	Zonolite Vermiculite / 19 Lb./ Burdie Feeds Inc (QC Replicate)	None Detected		Organics Acid Solubles Other Nonasbestos	8.88 43.79 47.33	DW DW	02/04/00 02/09/00	GG	02/10/00
000109-20	00054211A	Schultz Seed Starter / 5.4 Lb / Eagles (QC Replicate)	None Detected		Organics Acid Solubles Other Nonasbestos	53.77 17.92 28.31	DW DW	02/04/00 02/09/00	GG	02/10/00

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000224

Report Date: May 25, 2000

Client Information	
Project Name:	Vermiculite -Commercial Product
Project No.:	ESD-045A
P. O. No.:	0001B10P40101C

Tracking Information		
Login:	Mar 10, 2000	*By:* DJ
Reviewed:	Mar 23, 2000	*By:* JH
Final Review:	May 25, 2000	*By:* TMM

Analysis Information	
Sample Type:	Bulk
Analysis Type:	Semi-Quantitative
Reference No.:	EPA/600/R-93/116 68-02-3266

FINAL TABLE

Transmission Electron Microscopy – Semi-Quantitative – Bulk Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Asbestiform Regulated Mineral Type	Weight Percent	Other Components	Weight Percent	Prepped By	Prep Date(s)	Analyst	Analysis Date
000224-01	54203	Whitney Farms Vermiculite - Fred Meyer	None Detected		Organics Acid Solubles Other Nonasbestos	3.24 61.36 35.40	DW	03/13/00	JH	03/22/00
000224-02	54205	Zonolite - Burdic Feed	Actinolite Tremolite **Total**	0.94 0.94 **1.88**	Organics Acid Solubles Other Nonasbestos	4.53 1.21 92.38	DW	03/13/00	JH	03/22/00
000224-03	54207	Thermo Rock - Carpihito Bros.	Actinolite	0.33	Organics Acid Solubles Other Nonasbestos	2.06 65.02 32.59	DW	03/13/00	JH	03/23/00
000224-04	104200	Zonolite Chubby & Tubby	None Detected		Organics Acid Solubles Other Nonasbestos	2.12 0.91 96.97	DW	03/13/00	JH	03/23/00

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000233

Report Date: June 1, 2000

Client Information	
Project Name:	Retail Home&Garden/MEL
Project No.:	Not Available
P. O. No.:	Not Available

Tracking Information			
Login:	Mar 13, 2000	*By:*	MH
Reviewed:	Mar 27, 2000	*By:*	JH
Final Review:	Jun 1, 2000	*By:*	TMM

Analysis Information	
Sample Type:	Bulk
Analysis Type:	Semi-Quantitative
Reference No.:	EPA/600/R-93/116 68-02-3266

FINAL TABLE

Transmission Electron Microscopy – Semi-Quantitative – Bulk Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Asbestiform Regulated Mineral Type	Weight Percent	Other Components	Weight Percent	Prepped By	Prep Date(s)	Analyst	Analysis Date
000233-01	54203	Whitney Farms Residue	None Detected		Organics Acid Solubles Other Nonasbestos	9.09 72.73 18.18	DW	03/14/00	JH	03/26/00
000233-02	54204	Scotts Residue	None Detected		Organics Acid Solubles Other Nonasbestos	2.50 87.50 10.00	DW	03/14/00	JH	03/26/00
000233-03	54205	Zonolite Residue	Tremolite	0.10	Organics Acid Solubles Other Nonasbestos	2.56 92.31 5.03	DW	03/14/00	JH	03/26/00
000233-04	54206	Zonolite Residue	Tremolite	2.79	Organics Acid Solubles Other Nonasbestos	0.00 72.09 25.12	DW	03/14/00	JH	03/26/00
000233-05	54207	ThermoRock	Actinolite	0.30	Organics Acid Solubles Other Nonasbestos	2.17 67.39 30.14	DW	03/14/00	JH	03/26/00
000233-06	80772	#3 Residue	Tremolite	0.24	Organics Acid Solubles Other Nonasbestos	28.57 47.62 23.57	DW	03/14/00	JH	03/26/00
000233-07	80773	#4 Residue	Tremolite	0.64	Organics Acid Solubles Other Nonasbestos	8.00 28.00 63.36	DW	03/14/00	JH	03/26/00

Attachment 3

GRACE

Industrial Chemicals Group
W.R. Grace & Co.
62 Whittemore Avenue
Cambridge, Mass. 02140

(617) 876-1400

April 1, 1980

Mr. Dale Ray
Consumer Product Safety Commission
Economic Program Analysis Division
Room 656-B
Washington, D.C. 20207

Dear Mr. Ray:

This will confirm our conference call of March 12, 1980 in which we reviewed with you the results of testing performed by the Construction Products Division of W. R. Grace & Co to determine the extent of asbestiform tremolite fiber release associated with use of Grace vermiculite in consumer products. During our conversation, you requested that we set out the details of Grace's fiber exposure test methodology and test results and indicate the nature of Grace's fiber reduction efforts.

As you know, tremolite is a tramp mineral contaminant which is associated with vermiculite and which Grace has been attempting to reduce to the maximum extent feasible. Since 1970, Grace has invested over $15 million to extract worthless materials and contaminants and to reduce airborne fiber exposure in its vermiculite mining, milling and expanding operations. A substantial part of this investment was associated with the construction by Grace of a new vermiculite mill at its Libby, Montana mine which uses wet screening and other wet ore beneficiation processes designed to reduce the asbestiform tremolite contaminant associated with vermiculite.

Following startup of the new mill, in early 1975, Grace took further steps to reduce tremolite contamination by removing and disposing of selected fines which have a higher level of contamination, thereby reducing the level of contamination in its finished ore concentrate. Since that time, changes have been made in the exfoliation process equipment used at Grace's vermiculite expanding plants which

process Grace vermiculite ore for use in both consumer and industrial products. These changes provided for further screening, separation, and removal of both fines and the heavier unexpanded residual high density material following exfoliation both of which may contain a higher level of asbestiform tremolite contamination than the finished product. By use of bag houses and other dust filtration equipment, including an air elutriation step, additional reduction of the tremolite fiber contamination of expanded vermiculite end product is accomplished.

Grace has taken the further step of developing a binding agent for its Zonolite(R) Attic Insulation product and has recently started up equipment at all its expanding plants to apply this binder to Attic Insulation to further reduce dust and exposure to asbestiform fibers during the use of this product.

As a result of these reductions in asbestiform tremolite contamination, we believe that consumer products containing vermiculite and sold by Grace do not generate unreasonable risks for users. This has been verified by Grace's fiber exposure tests of consumer products containing expanded Grace vermiculite ore. All measurements were made by the NIOSH-approved technique as set forth in 40 CFR Section 1910.1001, paragraphs (e) and (f), utilizing the membrane filter method at 400-450 X (magnification) (4 millimeter objective) with phase contrast illumination. The results of these tests were as follows:

Product	Fibers Detected
Terra-Lite(R) Vermiculite	None Detected
Redi-Earth(R)	None Detected
Lightweight Fertilizer (Scott's Turf Builder)	None Detected
Zonolite Attic Insulation	Some fibers detected during installation

The actual test protocols and results of the tests are shown in Annex A to this letter. No tests were performed on Pool Cushion (R), a Grace product, which is used for protection of the base of vinyl-lined above-ground swimming pools since this use occurs out-of-doors and, typically, involves no more than 3 to 12 bags of vermiculite, depending on the size of the pool.

Sent by.

The only Grace product whose use resulted in a detectable fiber exposure was Attic Insulation and, then, at low levels only during installation. Tests indicate no residual fiber release following installation. Since this product is unlikely to be used more than two or three times during an entire lifetime and, then, only for exposure times which would not be expected to exceed two hours in any one case, the lifetime dosage is several orders of magnitude lower than any promulgated government standard applicable to tremolite fiber exposure.

Grace is continuing to exert its best efforts to further reduce the asbestiform tremolite contamination associated with its vermiculite products to the maximum extent feasible. For example, beginning in May of this year, a new rock and tremolite removal circuit should be operational at the Libby mill. This circuit is expected to reduce the level of tremolite contamination in fine size vermiculite ore by 50%. Additional research is underway to develop a similar circuit for reduction of tremolite contamination in the coarser sizes of vermiculite ore used for Zonolite Attic Insulation. One promising separation technique is slot screening which, if successful, could reduce tremolite contamination in the coarse ore concentrate by over 50%.

We are rapidly approaching a point of diminishing return since the amount of asbestiform tremolite contaminant in the vermiculite ore presently shipped to the exfoliating plants averages only 0.5% on a dry weight basis. For expanded vermiculite products, the level of contaminant is on average at or below the lowest level of reliable detectability, 0.2% on a dry weight basis. Accordingly, the 50% reduction Grace expects to achieve in the fine ores by May and, ultimately, the coarse ore sizes is a reduction from an already very low contaminant level. With this background, it is clear to us that the task of further reducing the remaining residual contamination in unexpanded ore and expanded vermiculite products will show a rapidly escalating cost in relation to the benefits derived.

We trust that this information will be useful to you in connection with the CPSC's evaluation of the asbestos contamination issue.

Very truly yours,

E. S. Wood
Executive Vice President

Attachment

ANNEX A

USER EXPOSURE TO FIBROUS TREMOLITE IN VERMICULITE CONSUMER PRODUCTS

TEST DATA

I. TEST PROTOCOL

A. Horticultural Products

1. Consumer Use of Terra-Lite(R) Vermiculite[a]

(a) Mix and fill pots to simulate consumer preparation of a mix of 50% peat moss and 50% Terra-Lite vermiculite by scooping equal volumes of materials out of separate packages and depositing on work surface. Hand mix to reasonable uniformity and fill fifteen (15) 4" diameter flower pots in 15 minutes. Press down to firm up the soil to hold the plant.

After 8 days the 15 pots were brought into the work area where three separate procedures were performed. Fiber counts were taken during each of these three procedures. Five pots were used for each of the three procedures.

(b) Knock Out and Disposal -- To simulate the consumer who does not intend to reuse the soil. Invert the pot and rap on the working surface so that the soil drops out. Brush the mound of soil off the bench into a disposal container. Take a paper towel and wipe inside of pot so that is is clean for reuse and dispose of the paper towel. In this procedure, contents of five pots will be disposed of during the 15 minute test period.

(c) Knock Out and Reuse for Potting Other Plants - Simulate a consumer who will reuse the potting soil. Rap pot on workbench by hand and break up the lump of soil to

make it similar to its original free-flowing condition. Repeat this five times. Combine all soil into one pile; then proceed to refill pots by scooping the material back in and tamping it down. In this 15 minute test procedure, five pots will be filled.

(d) Knock Out and Blend with New Potting Soil - Simulate a consumer who will blend old with new potting soil. Rap pot on workbench by hand and break up the lump of soil to make it similar to its original free-flowing condition. Repeat procedure five times. Obtain additional potting soil to match the volume of the dried soil. Place new soil on top of the old soil and mix together by hand. Use this mix to fill pots. During this 15 minute test procedure, 10 pots are filled.

2. Consumer Use of Redi-Earth(R) Potting Soil[b]

(a) Same procedure as 1 (a) except substitute premixed Redi-earth for Terra-Lite Vermiculite as the soil medium.

(b) Same procedure as 1 (b).

(c) Same procedure as 1 (c).

(d) Same procedure as 1 (d).

B. Consumer Use of Lightweight Fertilizer[c]

1. General

A five building apartment complex was selected as the test site. With over 100,000 sq. ft. of grass area, the site allowed air sampling while fertilizing over an extended period of time.

the spreader hopper and fertilizing, and the other maintaining log sheets, time and pump calibrations.

2. Application of Lightweight Lawn Fertilizer

Two sampling pumps with filter cassettes located in the left and right breathing zones were worn by the applicator during the sampling/fertilizing period. The applicator filled the spreader hopper to within 2" of the top and refilled when the hopper was approximately 3/4ths empty. Using a new Model 35 Scotts spreader with guide markers, the applicator spread thirteen (13) bags of lawn fertilizer at the normal coverage application rate (5000 ft^2/bag).

C. Consumer Installation of Vermiculite Attic Insulation[d]

1. General

Vermiculite Attic Insulation is generally purchased in quantities of 10 - 100 bags per home to "retrofit" or "add to" existing insulation in an existing home. Seldom is vermiculite Attic Insulation installed in new construction. To determine consumer exposure to tremolite fibers, the following series of tests by home owners was intended to indicate actual exposures under a variety of conditions.

2. Area Engineering Samples

Engineering samples were taken as follows:

(a) Prior to installing vermiculite Attic Insulation, monitor attic space for 5 - 6 hours.

(b) Approximately two months after installing insulation, monitor attic space for 5 - 6 hours.

Pouring/Leveling Vermiculite Attic Insulation in a Home

Each test home utilized 40 - 70 bags (3 cubic feet each) of vermiculite Attic Insulation. The installer was monitored during the placement of insulation.

Initially, place 15 - 20 bags in the attic. The installer poured all bags and leveled insulation with a wooden hand screed or one with a handle to push insulation back into roof eaves. Additional bags were brought to the attic in lots of 15 - 20 bags as required.

NOTES:

(a) Terra-Lite vermiculite is composed of expanded #3 vermiculite ore from either Libby, Montana or Enoree, South Carolina.

(b) Redi-Earth is a potting soil consisting of a mixture of 50% peat moss and 50% expanded #3 vermiculite ore from either Libby, Montana or Enoree, South Carolina with plant nutrients added.

(c) Lightweight fertilizer utilizes expanded #4 vermiculite ore from either Libby, Montana or Enoree, South Carolina.

(d) Attic Insulation is composed of expanded #1 or #2 vermiculite ore available only from Libby, Montana.

(e) Pool Cushion which was not tested utilizes expanded #3 vermiculite ore from either Libby, Montana or Enoree, South Carolina.

3. Roofing/Leveling Vermiculite Attic Insulation in a Home

Each test home utilized 40 - 70 bags (3 cubic feet each) of vermiculite Attic Insulation. The installer was monitored during the placement of insulation.

Initially, place 15 - 20 bags in the attic. The installer poured all bags and leveled insulation with a wooden hand screed or one with a handle to push insulation back into roof eaves. Additional bags were brought to the attic in lots of 15 - 20 bags as required.

NOTES:

(a) Terra-Lite vermiculite is composed of expanded #3 vermiculite ore from either Libby, Montana or Enoree, South Carolina.

(b) Redi-Earth is a potting soil consisting of a mixture of 50% peat moss and 50% expanded #3 vermiculite ore from either Libby, Montana or Enoree, South Carolina with plant nutrients added.

(c) Lightweight fertilizer utilizes expanded #4 vermiculite ore from either Libby, Montana or Enoree, South Carolina.

(d) Attic Insulation is composed of expanded #1 or #2 vermiculite ore available only from Libby, Montana.

(e) Pool Cushion which was not tested utilizes expanded #3 vermiculite ore from either Libby, Montana or Enoree, South Carolina.

II. RESULTS (See note 1)

	PERSONNEL AVE. EXPOSURE (f/cc)		PERSONNEL TWA EXPOSURE (f/cc)	
A. HORTICULTURAL PRODUCTS (see Note 2)	South Carolina	Montana	South Carolina	Montan
1. Consumer Use of Terra-Lite Vermiculite				
(a) Mix and Fill Pots	<0.29	<0.14	<0.073	<0.035
(b) Knock Out and Disposal	<0.14	<0.14	<0.035	<0.035
(c) Knock Out and Reuse	<0.14	<0.14	<0.035	<0.035
(d) Knock Out and Blend	<0.14	<0.14	<0.035	<0.035
2 Consumer Use of Redi-Earth				
(a) Mix and Fill Pots	<0.29	<0.14	<0.073	<0.035
(b) Knock Out and Disposal	<0.14	<0.14	<0.035	<0.035
(c) Knock Out and Reuse	<0.14	<0.14	<0.035	<0.035
(d) Knock Out and Blend	<0.14	<0.14	<0.035	<0.035
B. LIGHTWEIGHT FERTILIZER				
1. Application of Lightweight Fertilizer With Montana derived vermiculite		<0.03		<0.008

C. Home Installation of Vermiculite Attic Insulation

1. Engineering/Area Samples

Home	Type Home	No. Bags	Fiber Concentration (f/cc) Attic Before	After (see note 3)
P	Colonial	55	0.03 (see note 4)	<0.01
N	Cape	30	NO TEST	<0.01
S	Ranch	64	<0.01	<0.01
W	Colonial	70	<0.01	<0.01

Home	Type Home	Personnel Exposure (f/cc) Ave	TWA (see note 5)
F	Colonial	2.597	0.649
N	Cape	0.971	0.243
S	Ranch	2.115	0.529
W	Colonial	1.746	0.436

NOTES:

1. The symbol < (less than) indicates no fibers were observed in the counted fields. As a measure of test precision, results are reported to be less than the value represented by one fiber if such had been detected in one of the observed fields.

According to NIOSH reports, the limit of reliable detectaility for this test procedure is 0.5 f/cc exposure and 0.1 f/cc TWA. Values below 0.5 f/cc exposure and 0.1 f/cc TWA are not judged as detectable.

2. Each test of horitcultural products was repeated using products made from both Libby, Montana ore and Enoree, South Carolina ore. The Grace vermiculite ore used in making Attic Insulation originates from the Libby, Montana mine as does the ore purchased by O. M. Scott & Sons for use in its lightweight lawn fertilizer.

3. In addition to results tabulated, two additional tests indicate no fibers detected in attics insulated with vermiculite loose fill in one case six hours and in another case approximately nine years after installation.

4. In all home attics tested, vermiculite Attic Insulation was added as a retrofit insulation over existing glass, mineral wool or cellulose insulation. In home "F", a fiber was observed in the counted fields prior to pouring vermiculite Attic Insulation. Although length and aspect ratio fell within the fiber definition, it is believed to be airborne glass fiber from existing insulation. There was no vermiculite Attic Insulation in the attic when this prejob sample was taken.

5. In calculating the time-weighted average (TWA) exposure for consumers using Attic Insulation, it is assumed that the user would work in the attic pouring Attic Insulation for two hours in one eight-hour work day. Results in C. 1., indicate no further exposures after installation. The lifetime exposure and risk associated with the use of Attic Insulation is infinitesimally small compared to industrial exposures since the opportunity for exposure is rare (perhaps twice in a lifetime) compared to a permitted industrial exposure up to 2 f/cc during each eight-hour work day throughout a working lifetime. Therefore, comparison of TWAs between a rare and nonroutine exposure in the case of Attic Insulation and the OSHA industrial standard of 2 f/cc vastly overstates the potential hazard involved in the use of Attic Insulation.

Attachment 4

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000146

Report Date: May 25, 2000

Client Information	
Project Name:	EPA Region 10 Vermiculite Project
Project No.:	Not Available
P. O. No.:	0Y0107NASX
Sample Type:	Air

Tracking Information		
Login:	Feb 17, 2000	*By:* GG
Prep:	Feb 18, 2000	*By:* DW
Verified:	Feb 18, 2000	*By:* DW
Reviewed:	Feb 21, 2000	*By:* JH
Final Review:	May 25, 2000	*By:* TMM

Analysis Information	
Analysis Type:	NIOSH
Reference No.:	7402
Min. Aspect Ratio:	3:1
Min. Length:	5 µm
Min. Width:	0.25 µm

FINAL TABLE

Transmission Electron Microscopy – NIOSH – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Concentration (struc/cc)	95% Confidence Interval (struc/cc)	Struc. Count	Opt. Vis. Asb. Fibs. (%)	Analytical Sens. (struc/cc)	Volume (liters)	Number of Grid Openings	Filter Area (mm^2)	Area Analyzed (mm^2)	Analyst	Analysis Date
000146-01 Test	00074200	Pump #1 Flowrate 2.85 l/m 30 min #1	ASBESTOS	<0.022	0 - 0.083	0	NA	0.022	85.5	20	385	0.2013	GG	2/18/00
			NON-ASBESTOS	<0.022	0 - 0.083	0								
			TOTAL	**<0.022**	**0 - 0.083**	**0**								
000146-02 Test	00074201	Pump #5 Flowrate 2.85 l/m 30 min #2	ASBESTOS	<0.022	0 - 0.083	0	NA	0.022	85.5	20	385	0.2013	GG	2/18/00
			NON-ASBESTOS	<0.022	0 - 0.083	0								
			TOTAL	**<0.022**	**0 - 0.083**	**0**								
000146-03 Test	00074202	Pump #1 Flowrate 2.8 l/m 30 min #3	ASBESTOS	<0.023	0 - 0.084	0	NA	0.023	84.0	20	385	0.2013	GG	2/18/00
			NON-ASBESTOS	<0.023	0 - 0.084	0								
			TOTAL	**<0.023**	**0 - 0.084**	**0**								
000146-04 Test	00074203	Pump #5 Flowrate 2.8 l/m 30 min #4	ASBESTOS	<0.023	0 - 0.084	0	0	0.023	84.0	20	385	0.2013	GG	2/18/00
			NON-ASBESTOS	0.068	0.014 - 0.200	3								
			TOTAL	**0.068**	**0.014 - 0.200**	**3**								
000146-05 Test	00074204	Pump #1 Flowrate 2.8 l/m 30 min #5	ASBESTOS	<0.023	0 - 0.084	0	0	0.023	84.0	20	385	0.2013	GG	2/18/00
			NON-ASBESTOS	0.023	0.001 - 0.127	1								
			TOTAL	**0.023**	**0.001 - 0.127**	**1**								
000146-06 Test	00074205	Pump #5 Flowrate 2.8 l/m 30 min #6	ASBESTOS	<0.023	0 - 0.084	0	0	0.023	84.0	20	385	0.2013	GG	2/18/00
			NON-ASBESTOS	0.046	0.006 - 0.164	2								
			TOTAL	**0.046**	**0.006 - 0.164**	**2**								

% Optically Visible Asbestos Fibers = (#Asbestos / #Total Fibers). This number indicates the representative fraction of asbestos to total fibers as defined by NIOSH 7400 standards and can be used as a factor to determine asbestos concentrations from PCM counts in similar sampling areas.

NA – Not Applicable. For samples in which no fiber types are found, percentage values do not apply.

NOTE: These counting rules are intended to coincide with NIOSH 7400 counting rules and do not measure smaller asbestos fiber populations below 5.0 µm lengths as would other TEM airborne analysis methods (AHERA, EPA - Yamate).

00014601.tem

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000146

Report Date: May 25, 2000

Client Information	
Project Name:	EPA Region 10 Vermiculite Project
Project No.:	Not Available
P. O. No.:	0Y0107NASX
Sample Type:	Air

Tracking Information		
Login:	Feb 17, 2000	*By:* GG
Prep:	Feb 18, 2000	*By:* DW
Verified:	Feb 18, 2000	*By:* DW
Reviewed:	Feb 21, 2000	*By:* JH
Final Review:	May 25, 2000	*By:* TMM

Analysis Information	
Analysis Type:	NIOSH
Reference No.:	7402
Min. Aspect Ratio:	3:1
Min. Length:	5 µm
Min. Width:	0.25 µm

FINAL TABLE

Transmission Electron Microscopy – NIOSH – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Concentration (struc/cc)	95% Confidence Interval (struc/cc)	Struc. Count	Opt. Vis. Asb. Fibs. (%)	Analytical Sens. (struc/cc)	Volume (liters)	Number of Grid Openings	Filter Area (mm^2)	Area Analyzed (mm^2)	Analyst	Analysis Date
000146-07 Test	00074206	Pump #1 Flowrate 2.8 l/m 30 min #7	ASBESTOS	<0.023	0 - 0.084	0	NA	0.023	84.0	20	385	0.2013	GG	2/21/00
			NON-ASBESTOS	<0.023	0 - 0.084	0								
			TOTAL	**<0.023**	**0 - 0.084**	**0**								
000146-08 Test	00074207	Pump #5 Flowrate 2.8 l/m 30 min #8	ASBESTOS	<0.023	0 - 0.084	0	0	0.023	84.0	20	385	0.2013	GG	2/21/00
			NON-ASBESTOS	0.023	0.001 - 0.127	1								
			TOTAL	**0.023**	**0.001 - 0.127**	**1**								
000146-09 Test	00074208	Blank 1	ASBESTOS	NA	NA - NA	0	NA	NA		20	385	0.2013	GG	2/21/00
			NON-ASBESTOS	NA	NA - NA	0								
			TOTAL	**NA**	**NA - NA**	**0**								
000146-10 Test	00074209	Blank 2	ASBESTOS	NA	NA - NA	0	NA	NA		20	385	0.2013	GG	2/21/00
			NON-ASBESTOS	NA	NA - NA	0								
			TOTAL	**NA**	**NA - NA**	**0**								
000146-11 Test	00074210	QC 1	ASBESTOS	NA	NA - NA	0	NA	NA		20	385	0.2013	GG	2/21/00
			NON-ASBESTOS	NA	NA - NA	0								
			TOTAL	**NA**	**NA - NA**	**0**								
000146-12 Test	00074211	QC 2	ASBESTOS	NA	NA - NA	0	NA	NA		20	385	0.2013	GG	2/21/00
			NON-ASBESTOS	NA	NA - NA	0								
			TOTAL	**NA**	**NA - NA**	**0**								

% Optically Visible Asbestos Fibers = (#Asbestos / #Total Fibers). This number indicates the representative fraction of asbestos to total fibers as defined by NIOSH 7400 standards and can be used as a factor to determine asbestos concentrations from PCM counts in similar sampling areas.

NA – Not Applicable. For samples in which no fiber types are found, percentage values do not apply.

NOTE: These counting rules are intended to coincide with NIOSH 7400 counting rules and do not measure smaller asbestos fiber populations below 5.0 µm lengths as would other TEM airborne analysis methods (AHERA, EPA - Yamate).

00014601.tem

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000147

Report Date: March 22, 2000

Client Information

Project Name: EPA Region 10 Vermiculite Project
Project No.: Not Available
P. O. No.: 0Y0107NASX
Sample Type: Air

Tracking Information

Login:	Feb 17, 2000	*By:* GG
Prep:	Feb 18, 2000	*By:* DW
Verified:	Feb 18, 2000	*By:* DW
Reviewed:	Feb 21, 2000	*By:* JH
Final Review:	Mar 22, 2000	*By:* JH

Analysis Information

Analysis Type: Modified EPA-II
Reference No.: 68 - 02 - 3266
Min. Aspect Ratio: 5:1
Min. Length: 0.5 µm
Min. Width: NA
Lab Filter Area: 227 mm²

FINAL TABLE

Transmission Electron Microscopy – Modified EPA-II (Direct and Indirect) – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Density (s/mm²)	Concentration (struc/cc)	95% Confidence Interval (struc/cc)	Struc. Count	Analytical Sens. (struc/cc)	Volume (liters)	Number of Grid Openings	Dilution Factor	Area Analyzed (mm²)	Analyst	Analysis Date
000147-01 Direct	00074212	Pump #3 Flowrate 11.1 l/m 100 mins #9	**TOTAL ASBESTOS**	**0**	**<0.005**	**0 - 0.018**	**0**	0.005	1110.0	5		0.0725	GG	2/21/00
			ASBESTOS >= 5 µm	0	<0.005	0 - 0.018	0							
			NON-ASBESTOS	13.8	0.005	0.000 - 0.027	1							
000147-02 Direct	00074213	Pump #4 Flowrate 11.15 l/m 100 mins #10	**TOTAL ASBESTOS**	**0**	**<0.005**	**0 - 0.018**	**0**	0.005	1115.0	5		0.0725	GG	2/21/00
			ASBESTOS >= 5 µm	0	<0.005	0 - 0.018	0							
			NON-ASBESTOS	0	<0.005	0 - 0.018	0							
000147-03 Direct	00074214	Pump #3 Flowrate 11.0 l/m 100 mins #11	**TOTAL ASBESTOS**	**0**	**<0.005**	**0 - 0.018**	**0**	0.005	1100.0	5		0.0725	GG	2/21/00
			ASBESTOS >= 5 µm	0	<0.005	0 - 0.018	0							
			NON-ASBESTOS	0	<0.005	0 - 0.018	0							
000147-04 Direct	00074215	Pump #4 Flowrate 11.0 l/m 100 mins #12	**TOTAL ASBESTOS**	**0**	**<0.005**	**0 - 0.018**	**0**	0.005	1100.0	5		0.0725	GG	2/21/00
			ASBESTOS >= 5 µm	0	<0.005	0 - 0.018	0							
			NON-ASBESTOS	13.8	0.005	0.000 - 0.027	1							
000147-05 Indirect	00074216	Pump #4 Flowrate 11.1 l/m 100 mins #13	**TOTAL ASBESTOS**	**4139.4**	**0.847**	**0.527 - 1.166**	**27**	0.031	1110.0	10	22.2	0.1449	JH	3/21/00
			ASBESTOS >= 5 µm	1993.1	0.408	0.217 - 0.697	13							
			NON-ASBESTOS	1533.1	0.314	0.150 - 0.577	10							
000147-06 Indirect	00074217	Pump #4 Flowrate 11.1 l/m 100 mins #14	**TOTAL ASBESTOS**	**2769.6**	**0.564**	**0.335 - 0.892**	**18**	0.031	1110.0	10	22.2	0.1449	JH	3/21/00
			ASBESTOS >= 5 µm	1226.5	0.251	0.108 - 0.494	8							
			NON-ASBESTOS	766.6	0.157	0.051 - 0.366	5							
000147-07 Blank	00074218	Blank #1	**TOTAL ASBESTOS**	N O T A N A L Y Z E D										
			ASBESTOS >= 5 µm NON-ASBESTOS											

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000147

Report Date: March 22, 2000

Client Information	
Project Name:	EPA Region 10 Vermiculite Project
Project No.:	Not Available
P. O. No.:	0Y0107NASX
Sample Type:	Air

Tracking Information		
Login:	Feb 17, 2000	*By:* GG
Prep:	Feb 18, 2000	*By:* DW
Verified:	Feb 18, 2000	*By:* DW
Reviewed:	Feb 21, 2000	*By:* JH
Final Review:	Mar 22, 2000	*By:* JH

Analysis Information	
Analysis Type:	Modified EPA-II
Reference No.:	68 - 02 - 3266
Min. Aspect Ratio:	5:1
Min. Length:	0.5 µm
Min. Width:	NA
Lab Filter Area:	227 mm²

FINAL TABLE

Transmission Electron Microscopy – Modified EPA-II (Direct and Indirect) – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Density (s/mm²)	Concentration (struc/cc)	95% Confidence Interval (struc/cc)	Struc. Count	Analytical Sens. (struc/cc)	Volume (liters)	Number of Grid Openings	Dilution Factor	Area Analyzed (mm²)	Analyst	Analysis Date
000147-08 Blank	00074219	Blank #2	**TOTAL ASBESTOS**	N O T A N A L Y Z E D										
			ASBESTOS >= 5 µm											
			NON-ASBESTOS											
000147-09 QC	74220	QC	**TOTAL ASBESTOS**	N O T A N A L Y Z E D										
			ASBESTOS >= 5 µm											
			NON-ASBESTOS											

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000225

Report Date: June 3, 2000

Client Information	
Project Name:	Vermiculite Air Samples
Project No.:	ESD-045A
P. O. No.:	0001B10P40101C
Sample Type:	Air

Tracking Information			
Login:	Mar 10, 2000	*By:*	DJ
Prep:	Mar 14, 2000	*By:*	DW
Verified:	Mar 14, 2000	*By:*	DW
Reviewed:	Mar 26, 2000	*By:*	JH
Final Review:	Jun 3, 2000	*By:*	TMM

Analysis Information	
Analysis Type:	EPA-II
Reference No.:	68 - 02 - 3266
Min. Aspect Ratio:	5:1
Min. Length:	0.5 µm
Min. Width:	NA

FINAL TABLE

Transmission Electron Microscopy – EPA-II – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Density (s/mm²)	Concentration (struc/cc)	95% Confidence Interval (struc/cc)	Struc. Count	Analytical Sens. (struc/cc)	Volume (liters)	Number of Grid Openings	Filter Area (mm²)	Area Analyzed (mm²)	Analyst	Analysis Date
000225-01	00104201	Pump #1	**TOTAL ASBESTOS**	**73.6**	**0.202**	**0.087 - 0.399**	**8**	0.025	82.5	10	385	0.1449	JH	3/25/00
Indirect			ASBESTOS >= 5 µm	64.4	0.177	0.071 - 0.365	7							
			NON-ASBESTOS	27.6	0.076	0.016 - 0.222	3							
000225-02	00104202	Pump #5	**TOTAL ASBESTOS**	**138.0**	**0.373**	**0.209 - 0.615**	**15**	0.025	84.0	10	385	0.1449	JH	3/25/00
Indirect			ASBESTOS >= 5 µm	92.0	0.249	0.119 - 0.457	10							
			NON-ASBESTOS	55.2	0.149	0.055 - 0.325	6							
000225-03	00104203	Field Blank	**TOTAL ASBESTOS**	**0**	**<3.055**	**0 - 11.273**	**0**	3.055	1.0	9	385	0.1260	JH	3/25/00
Direct			ASBESTOS >= 5 µm	0	<3.055	0 - 11.273	0							
			NON-ASBESTOS	0	<3.055	0 - 11.273	0							
000225-04	00104204	QC Unopened	**TOTAL ASBESTOS**	**0**	**<2.829**	**0 - 10.439**	**0**	2.829	1.0	10	385	0.1361	JH	3/25/00
Direct			ASBESTOS >= 5 µm	0	<2.829	0 - 10.439	0							
			NON-ASBESTOS	0	<2.829	0 - 10.439	0							
000225-05	00104205	Pump #1	**TOTAL ASBESTOS**	**138.0**	**0.380**	**0.010 - 2.115**	**1**	0.380	82.5	10	385	0.1449	JH	3/25/00
Indirect			ASBESTOS >= 5 µm	138.0	0.380	0.010 - 2.115	1							
			NON-ASBESTOS	965.9	2.658	1.067 - 5.475	7							
000225-06	00104206	Pump #5	**TOTAL ASBESTOS**	**27.6**	**0.080**	**0.017 - 0.235**	**3**	0.027	78.0	10	385	0.1449	JH	3/25/00
Indirect			ASBESTOS >= 5 µm	27.6	0.080	0.017 - 0.235	3							
			NON-ASBESTOS	64.4	0.187	0.075 - 0.386	7							
000225-07	00104207	Background Pump #1	**TOTAL ASBESTOS**	**0**	**<0.031**	**0 - 0.116**	**0**	0.031	87.0	10	385	0.1405	JH	3/25/00
Direct			ASBESTOS >= 5 µm	0	<0.031	0 - 0.116	0							
			NON-ASBESTOS	0	<0.031	0 - 0.116	0							
000225-08	00104208	Background Pump #5	**TOTAL ASBESTOS**	**0**	**<0.031**	**0 - 0.113**	**0**	0.031	87.0	10	385	0.1449	JH	3/25/00
Direct			ASBESTOS >= 5 µm	0	<0.031	0 - 0.113	0							
			NON-ASBESTOS	13.8	0.061	0.007 - 0.220	2							

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000225

Report Date: June 3, 2000

Client Information	
Project Name:	Vermiculite Air Samples
Project No.:	ESD-045A
P. O. No.:	0001B10P40101C
Sample Type:	Air

Tracking Information			
Login:	Mar 10, 2000	*By:*	DJ
Prep:	Mar 14, 2000	*By:*	DW
Verified:	Mar 14, 2000	*By:*	DW
Reviewed:	Mar 26, 2000	*By:*	JH
Final Review:	Jun 3, 2000	*By:*	TMM

Analysis Information	
Analysis Type:	EPA-II
Reference No.:	68 - 02 - 3266
Min. Aspect Ratio:	5:1
Min. Length:	0.5 µm
Min. Width:	NA

FINAL TABLE

Transmission Electron Microscopy – EPA-II – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Density (s/mm²)	Concentration (struc/cc)	95% Confidence Interval (struc/cc)	Struc. Count	Analytical Sens. (struc/cc)	Volume (liters)	Number of Grid Openings	Filter Area (mm²)	Area Analyzed (mm²)	Analyst	Analysis Date
000225-09	00104209	Pump #1	**TOTAL ASBESTOS**	**2621.6**	**6.960**	**4.191 - 10.869**	**19**	0.366	85.5	10	385	0.1449	JH	3/25/00
Indirect			ASBESTOS >= 5 µm	1103.8	2.931	1.264 - 5.773	8							
			NON-ASBESTOS	1103.8	2.931	1.264 - 5.773	8							
000225-10	00104210	Pump #5	**TOTAL ASBESTOS**	**3131.3**	**8.170**	**4.756 - 11.584**	**22**	0.371	87.0	10	385	0.1405	JH	3/26/00
Indirect			ASBESTOS >= 5 µm	854.0	2.228	0.817 - 4.850	6							
			NON-ASBESTOS	1281.0	3.342	1.530 - 6.321	9							
000225-11	00104211	Field Blank	**TOTAL ASBESTOS**	**0**	**<2.656**	**0 - 9.801**	**0**	2.656	1.0	10	385	0.1449	JH	3/25/00
Direct			ASBESTOS >= 5 µm	0	<2.656	0 - 9.801	0							
			NON-ASBESTOS	0	<2.656	0 - 9.801	0							
000225-12	00104212	QC Blank Unopened	**TOTAL ASBESTOS**	**0**	**<2.656**	**0 - 9.801**	**0**	2.656	1.0	10	385	0.1449	JH	3/25/00
Direct			ASBESTOS >= 5 µm	0	<2.656	0 - 9.801	0							
			NON-ASBESTOS	0	<2.656	0 - 9.801	0							

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000370

Report Date: June 6, 2000

Client Information	
Project Name:	Vermiculite Project
Project No.:	Not Available
P. O. No.:	0Y0107NASX
Sample Type:	Air

Tracking Information			
Login:	Apr 14, 2000	*By:*	BAR
Prep:	Apr 17, 2000	*By:*	DW
Verified:	Apr 17, 2000	*By:*	DW
Reviewed:	Apr 20, 2000	*By:*	JH
Final Review:	Jun 6, 2000	*By:*	JH

Analysis Information	
Analysis Type:	NIOSH
Reference No.:	7402
Min. Aspect Ratio:	3:1
Min. Length:	5 µm
Min. Width:	0.25 µm

FINAL TABLE

Transmission Electron Microscopy – NIOSH – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Concentration (struc/cc)	95% Confidence Interval (struc/cc)	Struc. Count	Opt. Vis. Asb. Fibs. (%)	Analytical Sens. (struc/cc)	Volume (liters)	Number of Grid Openings	Filter Area (mm^2)	Area Analyzed (mm^2)	Analyst	Analysis Date
000370-01 Test	00154012	Work Area Background	ASBESTOS	<0.029	0 - 0.109	0	0	0.029	32.5	40	385	0.4026	JH	4/19/00
			NON-ASBESTOS	0.088	0.018 - 0.258	3								
			TOTAL	**0.088**	**0.018 - 0.258**	**3**								
000370-02 Test	00154013	Work Area Background	ASBESTOS	<0.031	0 - 0.114	0	0	0.031	31.0	40	385	0.4026	JH	4/19/00
			NON-ASBESTOS	0.031	0.001 - 0.172	1								
			TOTAL	**0.031**	**0.001 - 0.172**	**1**								
000370-03 Test	00154014	QC Unopened	ASBESTOS	NA	NA - NA	0	0	NA		40	385	0.4026	JH	4/19/00
			NON-ASBESTOS	NA	NA - NA	2								
			TOTAL	**NA**	**NA - NA**	**2**								
000370-04 Test	00154015	Field Blank	ASBESTOS	NA	NA - NA	0	NA	NA		40	385	0.4026	JH	4/19/00
			NON-ASBESTOS	NA	NA - NA	0								
			TOTAL	**NA**	**NA - NA**	**0**								
000370-05 Test	00154016	Field Blank	ASBESTOS	NA	NA - NA	0	0	NA		40	385	0.3927	JH	4/19/00
			NON-ASBESTOS	NA	NA - NA	1								
			TOTAL	**NA**	**NA - NA**	**1**								
000370-06 Test	00154019	Pump 1	ASBESTOS	<0.063	0 - 0.234	0	0	0.063	15.1	40	385	0.4026	JH	4/20/00
			NON-ASBESTOS	0.508	0.219 - 1.001	8								
			TOTAL	**0.508**	**0.219 - 1.001**	**8**								

% Optically Visible Asbestos Fibers = (#Asbestos / #Total Fibers). This number indicates the representative fraction of asbestos to total fibers as defined by NIOSH 7400 standards and can be used as a factor to determine asbestos concentrations from PCM counts in similar sampling areas.

NA – Not Applicable. For samples in which no fiber types are found, percentage values do not apply.

NOTE: These counting rules are intended to coincide with NIOSH 7400 counting rules and do not measure smaller asbestos fiber populations below 5.0 µm lengths as would other TEM airborne analysis methods (AHERA, EPA - Yamate).

00037002.tem

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000370

Report Date: June 6, 2000

Client Information	
Project Name:	Vermiculite Project
Project No.:	Not Available
P. O. No.:	0Y0107NASX
Sample Type:	Air

Tracking Information		
Login:	Apr 14, 2000	*By:* BAR
Prep:	Apr 17, 2000	*By:* DW
Verified:	Apr 17, 2000	*By:* DW
Reviewed:	Apr 20, 2000	*By:* JH
Final Review:	Jun 6, 2000	*By:* JH

Analysis Information	
Analysis Type:	NIOSH
Reference No.:	7402
Min. Aspect Ratio:	3:1
Min. Length:	5 µm
Min. Width:	0.25 µm

FINAL TABLE

Transmission Electron Microscopy – NIOSH – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Concentration (struc/cc)	95% Confidence Interval (struc/cc)	Struc. Count	Opt. Vis. Asb. Fibs. (%)	Analytical Sens. (struc/cc)	Volume (liters)	Number of Grid Openings	Filter Area (mm^2)	Area Analyzed (mm^2)	Analyst	Analysis Date
000370-07 Test	00154018	Pump 5	ASBESTOS NON-ASBESTOS	<0.060 0.480	0 - 0.221 0.207 - 0.946	0 8	0	0.060	15.9	40	385	0.4026	JH	4/20/00
			TOTAL	**0.480**	**0.207 - 0.946**	**8**								
000370-08 Test	00154020	Pump 5	ASBESTOS NON-ASBESTOS	<0.060 0.482	0 - 0.222 0.208 - 0.949	0 8	0	0.060	15.9	40	385	0.4026	JH	4/20/00
			TOTAL	**0.482**	**0.208 - 0.949**	**8**								
000370-09 Test	00154021	Pump 1	ASBESTOS NON-ASBESTOS	<0.064 0.701	0 - 0.235 0.350 - 1.253	0 11	0	0.064	15.0	40	385	0.4026	JH	4/20/00
			TOTAL	**0.701**	**0.350 - 1.253**	**11**								
000370-10 Test	00154022	Pump 5	ASBESTOS NON-ASBESTOS	<0.060 0.780	0 - 0.221 0.415 - 1.334	0 13	0	0.060	15.9	40	385	0.4026	JH	4/20/00
			TOTAL	**0.780**	**0.415 - 1.334**	**13**								
000370-11 Test	00154023	Pump 1	ASBESTOS NON-ASBESTOS	<0.064 0.702	0 - 0.235 0.350 - 1.256	0 11	0	0.064	15.0	40	385	0.4026	JH	4/20/00
			TOTAL	**0.702**	**0.350 - 1.256**	**11**								
000370-12 Test	00154000	Pump 5	ASBESTOS NON-ASBESTOS	0.344 1.569	0.158 - 0.651 1.089 - 2.049	9 41	18	0.038	40.0	25	385	0.2516	JH	4/20/00
			TOTAL	**1.913**	**1.383 - 2.444**	**50**								

% Optically Visible Asbestos Fibers = (#Asbestos / #Total Fibers). This number indicates the representative fraction of asbestos to total fibers as defined by NIOSH 7400 standards and can be used as a factor to determine asbestos concentrations from PCM counts in similar sampling areas.

NA – Not Applicable. For samples in which no fiber types are found, percentage values do not apply.

NOTE: These counting rules are intended to coincide with NIOSH 7400 counting rules and do not measure smaller asbestos fiber populations below 5.0 µm lengths as would other TEM airborne analysis methods (AHERA, EPA - Yamate).

00037002.tem

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000370 *Report Date:* June 6, 2000

Client Information	
Project Name:	Vermiculite Project
Project No.:	Not Available
P. O. No.:	0Y0107NASX
Sample Type:	Air

Tracking Information		
Login:	Apr 14, 2000	*By:* BAR
Prep:	Apr 17, 2000	*By:* DW
Verified:	Apr 17, 2000	*By:* DW
Reviewed:	Apr 20, 2000	*By:* JH
Final Review:	Jun 6, 2000	*By:* JH

Analysis Information	
Analysis Type:	NIOSH
Reference No.:	7402
Min. Aspect Ratio:	3:1
Min. Length:	5 µm
Min. Width:	0.25 µm

FINAL TABLE
Transmission Electron Microscopy – NIOSH – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Concentration (struc/cc)	95% Confidence Interval (struc/cc)	Struc. Count	Opt. Vis. Asb. Fibs. (%)	Analytical Sens. (struc/cc)	Volume (liters)	Number of Grid Openings	Filter Area (mm^2)	Area Analyzed (mm^2)	Analyst	Analysis Date
000370-13	00154001	Pump 1	ASBESTOS	0.352	0.176 - 0.630	11	25	0.032	29.9	40	385	0.4026	JH	4/18/00
			NON-ASBESTOS	1.056	0.696 - 1.416	33								
Test			**TOTAL**	**1.408**	**0.992 - 1.824**	**44**								
000370-14	00154002	Pump 1	ASBESTOS	0.342	0.148 - 0.674	8	17	0.043	22.4	40	385	0.4026	JH	4/21/00
			NON-ASBESTOS	1.710	1.180 - 2.240	40								
Test			**TOTAL**	**2.052**	**1.472 - 2.633**	**48**								
000370-15	00154003	Pump 5	ASBESTOS	0.160	0.052 - 0.373	5	13	0.032	29.9	40	385	0.4026	JH	4/22/00
			NON-ASBESTOS	1.055	0.695 - 1.415	33								
Test			**TOTAL**	**1.215**	**0.829 - 1.601**	**38**								
000370-16	00154006	Field Blank opened 2 sec.	ASBESTOS	NA	NA - NA	0	0	NA		40	385	0.4026	JH	4/24/00
			NON-ASBESTOS	NA	NA - NA	2								
Test			**TOTAL**	**NA**	**NA - NA**	**2**								
000370-17	00154007	QC Unopened	ASBESTOS	NA	NA - NA	0	0	NA		40	385	0.4026	JH	4/23/00
			NON-ASBESTOS	NA	NA - NA	2								
Test			**TOTAL**	**NA**	**NA - NA**	**2**								
000370-18	00154008	Pump 1	ASBESTOS	0.702	0.350 - 1.256	11	24	0.064	15.0	40	385	0.4026	JH	4/23/00
			NON-ASBESTOS	2.233	1.493 - 2.973	35								
Test			**TOTAL**	**2.935**	**2.087 - 3.784**	**46**								

% Optically Visible Asbestos Fibers = (#Asbestos / #Total Fibers). This number indicates the representative fraction of asbestos to total fibers as defined by NIOSH 7400 standards and can be used as a factor to determine asbestos concentrations from PCM counts in similar sampling areas.

NA – Not Applicable. For samples in which no fiber types are found, percentage values do not apply.

NOTE: These counting rules are intended to coincide with NIOSH 7400 counting rules and do not measure smaller asbestos fiber populations below 5.0 µm lengths as would other TEM airborne analysis methods (AHERA, EPA - Yamate).

00037002.tem

Lab/Cor, Inc.

A Professional Service Corporation in the Northwest

Report Number: 000370

Report Date: June 6, 2000

Client Information	
Project Name:	Vermiculite Project
Project No.:	Not Available
P. O. No.:	0Y0107NASX
Sample Type:	Air

Tracking Information			
Login:	Apr 14, 2000	*By:*	BAR
Prep:	Apr 17, 2000	*By:*	DW
Verified:	Apr 17, 2000	*By:*	DW
Reviewed:	Apr 20, 2000	*By:*	JH
Final Review:	Jun 6, 2000	*By:*	JH

Analysis Information	
Analysis Type:	NIOSH
Reference No.:	7402
Min. Aspect Ratio:	3:1
Min. Length:	5 µm
Min. Width:	0.25 µm

FINAL TABLE

Transmission Electron Microscopy – NIOSH – Air Sample Analysis

Lab/Cor Sample No.	Client Sample No.	Description	Fiber Type	Concentration (struc/cc)	95% Confidence Interval (struc/cc)	Struc. Count	Opt. Vis. Asb. Fibs. (%)	Analytical Sens. (struc/cc)	Volume (liters)	Number of Grid Openings	Filter Area (mm^2)	Area Analyzed (mm^2)	Analyst	Analysis Date
000370-19 Test	00154009	Pump 5	ASBESTOS	0.477	0.206 - 0.940	8	16	0.060	16.0	40	385	0.4026	JH	4/22/00
			NON-ASBESTOS	2.445	1.697 - 3.193	41								
			TOTAL	**2.922**	**2.104 - 3.740**	**49**								
000370-20 Test	00154010	Pump 1	ASBESTOS	0.249	0.068 - 0.638	4	11	0.062	15.3	40	385	0.4026	JH	4/24/00
			NON-ASBESTOS	2.056	1.355 - 2.758	33								
			TOTAL	**2.306**	**1.563 - 3.049**	**37**								
000370-21 Test	00154011	Pump 5	ASBESTOS	0.948	0.542 - 1.539	16	27	0.059	16.1	40	385	0.4026	JH	4/22/00
			NON-ASBESTOS	2.548	1.786 - 3.309	43								
			TOTAL	**3.495**	**2.604 - 4.387**	**59**								

% Optically Visible Asbestos Fibers = (#Asbestos / #Total Fibers). This number indicates the representative fraction of asbestos to total fibers as defined by NIOSH 7400 standards and can be used as a factor to determine asbestos concentrations from PCM counts in similar sampling areas.

NA – Not Applicable. For samples in which no fiber types are found, percentage values do not apply.

NOTE: These counting rules are intended to coincide with NIOSH 7400 counting rules and do not measure smaller asbestos fiber populations below 5.0 µm lengths as would other TEM airborne analysis methods (AHERA, EPA - Yamate).

00037002.tem

SAMPLING AND ANALYSIS OF CONSUMER GARDEN PRODUCTS THAT CONTAIN VERMICULITE

Prepared for:

Fibers and Organics Branch
National Program Chemicals Division
Office of Pollution Prevention and Toxics
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

Prepared by:

Versar, Inc.
6850 Versar Center
Springfield, Virginia 22151

August 22, 2000

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1.0 INTRODUCTION

In 1985, EPA evaluated consumer exposures to asbestos in products (e.g., horticultural products) containing vermiculite (Versar, 1985). The exposure assessment used analytical data for exfoliated vermiculite from a 1982 report prepared by MRI (MRI, 1982). The analytical data from the MRI (1982) report were presented in terms of the percent asbestos in raw, beneficiated, or exfoliated vermiculite ore. No data were provided on the asbestos content of vermiculite-containing consumer products. A summary of the analytical results from the MRI (1982) study is provided in Table 1. Raw ore from the Libby, Montana, mine had estimated asbestos contents ranging from 21 to 26 percent, while ore from their Enoree, South Carolina, mine had <1 percent asbestos. Beneficiated Grade Vermiculite ranged from 0.3 to 7 percent at the Libby site and was <1 percent at the Enoree site. Exfoliated vermiculite was evaluated from the Enoree site, but not the Libby site. The asbestos content was <1 percent. The W.R. Grace Company also analyzed bulk samples of vermiculite from their mine in South Carolina (IOM, no date). Their procedure involved extracting vermiculite, chlorite, chrysotile, and other minerals, leaving only amphibole fibers and examining samples by scanning electron microscope (SEM) and x-ray diffraction. The results indicated that the bulk material contained actinolite at low levels (i.e., approximately 0.002%). Similar analyses were conducted using two expanded vermiculite samples from South Carolina (IOM, 1993). Only trace amounts of asbestos fibers were observed in these samples. In 1990, the Libby mine was closed. Presumably, vermiculite in currently produced consumer product lines originates from the South Carolina or Virginia mines, or mines located outside the United States. Inhalation exposure to consumer products was assessed in the Versar (1985) report using data on the percent asbestos in exfoliated vermiculite, and assumptions regarding the amount of vermiculite in consumer products, the quantity of dust generated during consumer use, and the volume of air affected, as well as other assumed exposure factors.

As a result of reports on residual contamination and the potential for human exposures in Libby, Montana from the now-closed vermiculite mine, and questions posed to EPA about consumer products that contain vermiculite, there was renewed interest in evaluating the potential consumer exposures to asbestos from the use of vermiculite-containing consumer products. Consumer exposure to asbestos-contaminated vermiculite can occur during handling of consumer products containing vermiculite such as, lawn and garden care products, fertilizers, packaging materials, and loose-fill attic insulation. EPA Region 10 initiated a study of consumer products containing vermiculite. Subsequently, EPA, Office of Pollution Prevention and Toxics (OPPT), National Program Chemicals Division (NPCD), requested that Versar conduct sampling and analysis of vermiculite-containing consumer products as an expansion and followup to the Region 10 study. This report briefly describes the results of consumer product survey conducted by EPA Region 10 as well

as a related survey of commercially available building products that was conducted by Region 6 (EPA Region 6, 2000). It also summarizes the methods used and results of the asbestos analyses from the recently-conducted EPA/OPPT/NPCD-Versar study of consumer products.

1.1 Results of Previously Conducted EPA Regional Analyses of Consumer Products for Asbestos Content

EPA Region 10 analyzed consumer products containing vermiculite. These products were intended for horticultural use (e.g., potting soil, horticultural vermiculite) or laboratory packing (e.g., Zonolite® chemical packaging). Initially, 16 bulk products were analyzed by polarized light microscopy (PLM) (Method EPA/600/R-93/116) and transmission electron microscopy (TEM) (Method EPA/600/R-93/116). The PLM results were either non-detect or trace for all products. Two products were positive for asbestos, based on the TEM results. These products were: Zonolite® Vermiculite (0.56% actinolite and 0.47% actinolite) and Coles Cactus Mix (0.45% actinolite). Based on these results, Zonolite® was further analyzed by TEM after sieving the sample using No. 10 and No. 35 screens. The results of this sample indicated 1.88% actinolite/tremolite in the dust portion that passed through the sieves. Further analysis by TEM gave results of 0.1% and 2.79% in the fraction of material analyzed. This analysis procedure involved a rinsing residue particle separation technique to further improve the ability to isolate and identify asbestos in the vermiculite containing products. The residue materials were placed in a beaker and rinsed with deionized water which was intended to wash any loose fibers from the vermiculite matrix. After the vermiculite had floated to the surface, 7 ml of water was extracted from the bottom of the beaker using a syringe and was then injected into a crucible. The crucible was covered and placed in a drying oven a 68° centigrade for two or three days until all the water had evaporated. The remaining residue located in the bottom of the crucible was removed and placed onto a microscope slide following the EPA semi-quantitative method: EPA/600/R-93/116. A second Zonolite® product (Chubby and Tubby) was analyzed, but no asbestos was detected. These results are shown in Table 2.

Region 10 also conducted air monitoring during use of these products using a "glove-box" technique. Three separate scenarios were used during the glove box study. The first scenario involved the potting of plants which involved emptying a container of vermiculite containing soil into a plastic tub and then manipulating the soil to break up clumps. The second scenario involved preparing potting soil by mixing 50% vermiculite and 50% peat moss in a container, while the third scenario involved using pure vermiculite such as that used for laboratory packing purposes. Jars were placed into a pan and then covered with vermiculite. The three glove box sampling studies took place over a period of either 15, 20, or 30 minutes. However, one of the manipulation of soil studies was run for 100 minutes. For Coles Cactus Mix, no asbestos was detected at a flow rate of 2.8 L/minute

for 30 minutes (NIOSH 7402) or 11.1 L/minute for 100 minutes (Modified EPA-II). Using Zonolite® Chemical Packaging Material mixed 50/50 with Sun/Gro Peat Moss, the total amount of asbestos detected ranged from 0.08 to 0.38 structures/cm^3 at an air flow rate of 2.8 L/m for 30 minutes and 0.56 to 0.85 structures/cm^3 at an air flow rate of 11.1L/minute for 100 minutes, using the modified EPA (1984) (EPA-II Method). When Zonolite® Chemical Packaging Material was tested unmixed, the total asbestos detected was 6.96 to 8.17 structures/cm^3 at an air flow rate of 2.9 L/minute for 30 minutes, using the NIOSH 7402 Method. TEM analysis was used to estimate fiber content in all samples (either NIOSH 7402 or Modified EPA-II Method). Use of two TEM methods was necessary because some samples could not be tested using the NIOSH 7402 Method due to the excessive amount of particulate accumulated on the filter. The filters required a redeposit process which is not covered in the NIOSH 7402 Method, but could be performed using the Modified EPA-II Method.

1.2 Other EPA Asbestos Surveys

In addition to the ongoing work in Libby, Montana, EPA's Superfund program is currently evaluating possible asbestos contamination at other current and former vermiculite mines and processing sites across the country. EPA's Boston office is developing an improved sample preparation technique for vermiculite products and exploring options for gathering information on vermiculite home insulation. Finally, EPA's Dallas office recently concluded the sampling of a limited number of building construction materials, not including vermiculite products, for asbestos content. The purpose of this survey was to determine whether these building materials contained more than one percent asbestos, the threshold for regulation under the Asbestos-in-Schools program. The results of the sampling indicated that none of the 50 products contained more than one percent asbestos.

2.0 METHODS USED FOR THE EPA/OPPT/NPCD CONSUMER PRODUCT STUDY

2.1 Consumer Product Collection

During the initial phase of the EPA/OPPT/NPCD-Versar study, a total of 33 vermiculite and vermiculite-based consumer products were purchased from retail stores (i.e., hardware and department stores) in 9 metropolitan locations throughout the United States by personnel in Versar's regional offices. In addition, vermiculite packaging material was purchased from a mail order company in Atlanta, Georgia . This material is typically used in packing laboratory materials. A bag of Zonolite® Chemical Packaging Vermiculite was also purchased by mail order (Figure 1). This material was purchased from Burdic Feed, located in Kent, Washington, where it was being sold for horticultural purposes. This is the same product that was found to be positive for asbestos content

by EPA Region 10 (2000). As a result of the initial collection efforts, 35 products were collected. Following the initial sampling and analysis, additional samples were received and added to the study. One additional product was purchased from a retail store in the Springfield, Virginia, area (i.e., metropolitan Washington, D.C., area). An additional sample of vermiculite packaging material was also collected by EPA/OPPT/NPCD personnel during an unrelated sampling event, and provided to Versar for analysis. This material came from a laboratory packaging company in Batavia, Illinois (VWR). It should be noted that VWR is a user, and not a distributor of laboratory packaging material. The original source of the material is not known. In addition, Region 10 supplied a small sample of material from a bag of Zonolite® Chemical Packaging Vermiculite that they had purchased from Burdic Feed in Kent, Washington. This material had been found to be positive for asbestos by EPA Region 10. A total of 38 materials were collected overall.

An attempt was made to ensure that the products purchased in the various locations would represent a broad range of product types and brands, with emphasis on locally packaged products to ensure that a wide variety of materials would be sampled. It should be noted, however, that a statistically-based sampling approach was not used. Thus, the products purchased may not be a nationally representative sample. A list of the products purchased in each of the various locations is provided in Table 3.

As indicated in Table 3, the products were composed of either vermiculite only, or a mixture of vermiculite, and organic, inorganic and other materials (i.e., soil-based vermiculite products such as potting soil and horticultural mixes). Other types of vermiculite-containing products, such as loose-fill attic insulation, were desired for this study, but are apparently not readily available to consumers and could not be located. Also, as shown in Table 3, some of the same products were purchased in more than one location. This was done to evaluate similarities or differences in the asbestos content of these products, based on the region where they were purchased. The products in Table 3 were mailed to Versar Headquarters in Springfield, Virginia, by the regional offices.

2.2 Bulk Product Sampling

Samples of the various products collected were taken in Springfield, Virginia, and sent to the EMSL Analytical Laboratories in Westmont, New Jersey. Although only a small sample (i.e., approximately 8 ounces) of the materials was required by the laboratory, most of these products were purchased in bags containing greater than 4 quarts. A sample of each product was collected using a clean stainless steel scoop. To ensure that samples were representative of the entire bag of material, composite samples of each product were collected by mixing equal portions of product from the top, middle, and bottom of the bag, for a total sample of approximately 8 ounces. Two sampling methods

were used for the Zonolite® purchased by mail order from a feed store in Kent, Washington. This material is the same as the bulk material that was found to be positive for asbestos by researchers in EPA Region 10 (2000). First, a composite sample was collected, as described above. A second sample was collected from the bottom of the bag to determine whether the asbestos content would be higher in the bottom of the bag as a result of gravitational settling. This procedure was also used to sample the bottom of the bag of Hoffman's vermiculite from Minnesota during the second sampling round. Clean, stainless steel scoops were used to place the samples into sterile jars which were sealed, labeled, and sent to the EMSL Analytical Laboratories for asbestos analysis. As a result of the initial collection effort, a total of 36 samples were prepared for laboratory analysis.

In a subsequent round of sampling, an additional 14 samples were collected to increase the number of samples analyzed by PLM and TEM to 50. Additional samples were comprised of repeat composite sampling of the 5 samples with quantifiable asbestos; repeat random composite sampling of 5 more of the original samples (i.e., some non-detect and some with detections below the limits of quantification); 1 Zonolite® sample collected by EPA Region 10 and sent to Versar (this sample came from the bottom 1/3 of a bag of Zonolite®, also purchased from Burdic Feed in Kent, Washington); 1 sample of the vermiculite packaging material from VWR, a laboratory supply company in Batavia, Illinois, that was collected by EPA Headquarters personnel during an unrelated sampling event; a sample from the gardening consumer product (Pursell's Stay-Green Vermiculite) that was purchased after the initial product collection round; and a sample from the bottom of the bag of the product (Hoffman's vermiculite from MN) found in the initial analysis to have the highest asbestos content.

2.3 Laboratory Analyses of Bulk Samples

The initial laboratory analysis of the bulk products for asbestos was conducted using 2 techniques: PLM (EPA 600/R-93-116) and TEM (EPA 600/R-93/116) (Figures 2 and 3). According to EMSL (Frasca, 2000), the following procedure was followed by EMSL for these analyses:

> For PLM analysis, samples were first ground to a level where the vermiculite plates were barely visible. Point count PLM analysis was performed on eight (8) slides running 50 points on each slide. For TEM analysis, the sample was ground further until the vermiculite plates were no longer visible by the eye. The potting soil samples were ashed (due to their high organic content) prior to grinding, recording their weight before ashing. Subsequently, 0.01 grams of powder was added to 100 mL of water, sonicated, and an aliquot of 5 mL was filtered onto a 47 mm filter which was then prepared for TEM analysis. For each sample, three areas were sampled and analyzed from the filter (i.e., the center, the edge, and in between). This was done to counter any variation in radial distribution of particulates. The TEM analysis was

performed by observing 10 grid openings for each of the three TEM grids at 2,000X magnification as well as 3 grid openings for each of the three TEM grids at 20,000X magnification. Cut offs of fibers sizes were observed to avoid counting twice. The mass of the observed fibers was then calculated, and following its extrapolation to the whole filter and to the whole mass of 0.01 grams, the asbestos percent count was determined.

The quantitation limits were 0.25 percent for PLM and 0.1 percent for TEM. PLM and TEM analyses were also conducted for the three new products collected during the second sampling round and for the repeat samples (i.e., 5 products with quantifiable asbestos, 5 other randomly selected products from the initial sampling round, and an additional sample from the bottom of the bag of the product with the highest asbestos content, based on the initial analysis).

Based on the results of the initial bulk analyses, several (i.e., five) samples that were positive for asbestos content using the initial TEM approach, were further analyzed using two additional techniques: the SOP 2000 (EMSL, 1999) and the Superfund Method (EPA, 1997a). The SOP 2000 method was expected to provide a more refined estimate of the asbestos content of these materials. This method involved sample preparation (i.e., grinding and sieving the sample to obtain a distribution of particle sizes); screening with a scanning electron microscope (SEM) to ensure that asbestos fibers had been removed from the vermiculite plates; and analysis by both PLM at 100x magnification (recording fibers with a 3:1 aspect ratio and determining if they are asbestiform using the criteria given in Appendix A of EPA 600/R-93/116) and TEM at 10,000x magnification. The asbestos percent obtained by PLM and TEM were added to obtain total asbestos content.

The Superfund method (EPA, 1997a) was designed to determine the amount of releasable asbestos in soils and bulk materials. It uses a horizontal tumbler to generate dust and a vertical elutriator (Figure 4) to separate the respirable fraction of the dust. The respirable fraction of dust is collected on filters. The filters are weighed and the mass of dust collected is plotted against time to determine the rate of dust release (EPA, 1997a). The asbestos content of the dust on the filters is quantified by TEM. The advantage of this method is that it provides results that are suitable for supporting risk assessments.

2.4 Consumer Use Simulation

Because the results of bulk product analyses are difficult to use in assessing inhalation risks to individuals who use these products, air sampling techniques were needed to evaluate potential releases of asbestos from these products to air. Risk is typically estimated as the concentration of

fibers per cubic centimeter of air (f/cc), weighted according to the frequency and duration of exposure, times the unit risk factor (cc/f) for asbestos. According to EPA's Integrated Risk Information System (IRIS) (EPA, 2000), "the unit risk factor [of 0.23] cc/f is based on fiber counts made by phase contrast microscopy (PCM) and should not be applied directly to measurements made by other techniques." However, PCM cannot distinguish between asbestos and non-asbestos fibers; it also cannot detect smaller or thinner fibers at all. According to EPA (2000), **?**PCM detects only fibers longer than 5 μm and >0.4 μm in diameter." TEM can identify asbestos fibers of all sizes and exclude non-asbestos fibers. Thus, for the purposes of estimating risk for this study, air samples were analyzed by both PCM and TEM. TEM results were reported for all fiber sizes and for fibers > 5μm only.

To simulate indoor product use and measure indoor air asbestos concentrations, a 10'x10'x10' containment was constructed within Versar's research and storage space (Figures 5 and 6). This facility is located less than a mile from Versar's headquarters building. The dimensions of the containment were selected to provide enough space for an individual to work inside the structure and simulate mixing soils, potting plants, or cleaning out containers of soil. The dimensions were also assumed to represent a homeowner's garage or small greenhouse. This containment unit was specially-designed to more closely resemble consumer exposure conditions than the glove box used in the Region 10 study. The containment was constructed from 6-mil polyethylene plastic with the frame work constructed from wood to provide a rigid structure. Duct tape was used to seal seams and no artificial ventilation was provided. This was assumed to represent conditions in a closed garage or greenhouse with no windows and a closed door. The unit was constructed on a flat concrete surface. The floor was covered with plastic as it is part of the containment.

Several products were used within the containment to simulate consumer product use. During the product simulation, an individual inside the containment opened a bag of vermiculite containing material, which was then placed on a rolling cart. On the cart the vermiculite was scooped from the bag and placed in a stainless steel bowl. The vermiculite was then manipulated by using a metal spoon to transfer the vermiculite to a second bowl. After this process, the material was discarded and new material was scooped from the bag. Initially, three products were tested. These were: Schultz Horticultural vermiculite, purchased in VA; Hoffman's vermiculite, purchased in MN; and Zonolite® Chemical Packaging Vermiculite, purchased by mail order from Burdic Feed in Kent, WA. The first two of these products were selected because quantifiable levels of asbestos were observed in them in previous tests. The Zonolite® was selected because another bag of the same material had been found to have quantifiable levels of asbestos by Region 10, based on bulk analyses of the whole product as well as the sieved product. Also, the physical characteristics of these products made them good candidates for this procedure because, based on qualitative observations, they represented a

wide range of "dustiness." The Schultz vermiculite had a moisture content that allowed clumping when hand pressure was applied. This texture was not representative of most of the products collected and it is not clear whether the moisture observed in this bag was typical of this product or whether the bag had absorbed moisture between the time it was packaged and the time it was sampled. The Hoffman's vermiculite was drier and dustier, but the Zonolite® had an even finer grain size with a much dustier appearance. The order at which the three products were tested in the containment was based on their observed "dustiness" with the least "dustiest" being tested first.

During a second set of simulations, four additional products were tested inside the containment; two had asbestos contents below the limit of quantification, and two were non-detect based on TEM bulk analyses. These products were: Jungle Growth Vermiculite, purchased in FL Country Cottage Horticultural Vermiculite, purchased in VA; Scott's Vermiculite, purchased in TX; and Kellogg's Vermiculite, purchased in CA. Three of the products were very "dusty," while the fourth (Kellogg's) was less "dusty." All seven of the products used in the simulation exercise were vermiculite and not vermiculite mixed with potting soil or some other ingredient. The containment was fully cleaned between each sampling event by wet wiping down all interior surfaces and allowing the air in the containment to be "changed out" through a Hepa Filtration device. The individual within the containment opened a bag of vermiculite and poured it into a second clean container. Simulated scooping, transferring, and mixing then took place similar to the first simulation event. An aliquot from the bag was previously collected; however, care was exercised to avoid unnecessary waste of the original material since future studies or sampling may be necessary or requested. All utensils, scoops, and containers were either cleaned prior to use or removed from their factory sealed packaging. Similar use of vermiculite that took place inside containment will take place in an open air environment much like that in the yard or on a deck.

The individual performing work inside the containment wore personal protective equipment (PPE), as necessary to protect from dusty environments (Figure 7). A Tyvek full body suit or equivalent was worn during all inside containment work. Respiratory protection consisted of a full face air purifying respirator (APR) equipped with HEPA/P-100 air filters. PVC gloves were also worn on the hands. During the work tasks the oxygen level inside the containment was monitored with the use of a four gas meter. A second person was situated outside the containment in case of emergency and to offer support during sampling activity. After the completion of sampling, the inside of the containment was wiped down with water, the containment was vacuumed to capture any residual fibers remaining in the air, and the individual inside followed a modified decontamination procedure similar to that followed on asbestos abatement projects.

Eight air samples were collected using both low volume and high volume pumps. Before and after each use, each of these pumps were calibrated using a Bios Dry-Cal unit. This device is highly accurate and served to document any pump fluctuation. Prior to sampling during vermiculite use, the study area was sampled to document fiber levels. This "pre-sampling" established what, if any, fibers were present within the ambient air, and if necessary may be used as a comparison measure of the inside containment sample results. Two of these samples were run using the high volume type air sample pump. Air flow was set at approximately 9-9.9 liters of air per minute. Two inside containment air sample pumps (Figure 8) were also hi-volume units which were run at 7-8 liters of air per minute, while a second set of hi-volume sample pumps was located outside the containment. While working inside the containment, the individual wore two low volume air sample pumps which were set at approximately 2.1 of air liters per minute and ran for 30 minutes. The cassettes were oriented to be located within the breathing zone. All high volume air samples ran for approximately 40 minutes.

Air samples were collected in an outside environment in much the same manner as that inside the containment (Figure 9). The products with the highest airborne levels from the containment study were used in the outdoor study. Three high volume pumps were placed downwind from the source of use. Additionally, two personal samples were collected on the individual performing the work.

All air samples were analyzed by both PCM and TEM. The NIOSH 7400 (NIOSH, 1994), and EPA Level II (EPA, 1984) methods were used. The NIOSH 7400 method is a direct preparation method in which fibers >5 μm in length with an aspect ratio >3:1 are counted (counting rules A were used) by PCM. All TEM air samples were prepared using EPA Level II, a direct preparation method, with the exception of those samples that were overloaded with particulate matter (i.e., dust). For these, an indirect sample preparation method was used to obtain some form of data for these samples (otherwise, the results would simply have been reported as overloaded), with the understanding that the samples may not fit the model (e.g., detection limits are higher). The appropriate number of blanks were also submitted, as outlined in the guidance documents for each of these methods.

2.5 Region 10 Bulk Product Method Using Sieving

An additional set of analyses was conducted to examine the asbestos content in the dust fraction of selected products and to evaluate potential relationships between the fiber content of air during use of consumer products containing vermiculite and the asbestos fiber content of the fine particles in these vermiculite products. This analysis was also an attempt to verify the results of EPA Region 10's results for Zonolite® that was purchased in Kent, Washington. Region 10 found that the asbestos content of Zonolite® dust that was generated by sieving the original product through

standard sieve sizes No. 10 and No. 35 had higher asbestos content (i.e., 1.88%) than the bulk product (i.e., approximately 0.5%).

The three initial products used in the indoor containment exercise, including the Zonolite® purchased by Versar from Burdic Feed in Kent, Washington, Schultz Vermiculite from Virginia, and Hoffman's Vermiculite from Minnesota, were sieved using the same method as Region 10 (Figure 10). These three samples were composite samples (i.e., based on a mix of samples taken from the top, middle, and bottom of the bag). An additional sample from the bottom of the Zonolite® bag was also analyzed to be consistent with the Region 10 analysis. This sample came from the bottom of the bag after the bag was moderately shaken 20 to 30 times. According to EMSL (2000), the following procedure was used:

> "Sieve vermiculite sample through No. 10 (2 mm) and No. 35 (500 μm) sieves. The coarse, medium, and fine portions were analyzed by Polarized Light Microscopy (PLM). The fine portion was still too coarse for Transmission Electron Microscopy (TEM) analysis and had to be broken down further with mortar and pestle. Of this fine powder, 0.01 grams was suspended in 100 mL of particle free, distilled neutral (pH 7) water, sonicated and 5 mL was filtered through a 47 mm diameter, mixed cellulose ester (MCE) filter with a 0.45 μm pore size. A small portion of the filter was then collapsed with acetone, etched, and analyzed by TEM."

The rationale for conducting this analysis was that if asbestos fibers are more likely to be found in the fine dust of the vermiculite product, the asbestos fibers would be concentrated in the dust that passes through the sieves. Analyzing only the dust fraction would, in effect, increase the possibility of detecting asbestos by PLM and TEM. If the percent asbestos could be quantified in the fine fraction as well as in the medium and coarse fractions, a refined estimate of the asbestos content (i.e., greater sensitivity with lower detection limits) of the whole product could be made.

3.0 RESULTS

3.1 Bulk PLM and TEM Analyses

Table 4 provides the results of the analyses by sample number and location of purchase. Appendix A provides copies of the Laboratory Reports. The results of the laboratory analysis of the initial 36 samples indicated that TEM was more sensitive than PLM in detecting asbestos in the products tested. Based on PLM analyses, none of the products tested had detectable levels of asbestos. Using TEM, however, 17 of the 36 samples had detectable asbestos. Of these 17 samples with detectable asbestos, only 5 had quantifiable levels (i.e., greater than 0.1 percent by weight) of

asbestos. The percent of asbestos by weight ranged from 0.13 percent to 0.70 percent for these 5 samples. All of these 5 materials were pure vermiculite products, and not soil-based vermiculite products. Also, the fiber type observed in these 5 samples was actinolite. The fiber types observed in all of the other positive samples were actinolite and chrysotile. It is interesting to note that two of the samples with quantifiable levels of asbestos are from the same product type (i.e., Ace Horticultural Grade Vermiculite), purchased in different locations (i.e., Miami, FL, and Minneapolis, MN). These samples had levels of 0.35 percent (FL), and 0.24 percent (MN). Also, three of the samples with quantifiable levels of asbestos (i.e., Hoffman's Vermiculite, Ace Horticultural Grade Vermiculite, and Earthgro's Best Vermiculite) are from products purchased in Minneapolis, MN. The other two products purchased in the Minneapolis area had non-detectable levels of asbestos. Another interesting observation is that asbestos fibers were observed (but not quantifiable) in the sample of Zonolite® Chemical Packaging Vermiculite that was collected from the bottom of the bag, but not in the composite sample. This may indicate that asbestos fibers may settle to the bottom of containers in which they are stored. To further investigate this phenomena, a sample was collected from the bottom of the bag of the product with the highest observed asbestos content (i.e., Hoffman's vermiculite from MN) and analyzed for asbestos. However, asbestos was not observed above the quantitation limit in this sample, using both PLM and TEM techniques. Tremolite was observed using PLM and actinolite was observed using TEM. Figure 11 shows an asbestos fiber as seen by TEM. Figure 12 shows a close-up view of an actinolite asbestos fiber provided by EMSL.

Resampling of the five positive samples was conducted. Laboratory PLM analyses of these samples indicated that non-quantifiable tremolite was observed in the two samples that had the highest asbestos (actinolite) in the original TEM analysis (non-detected in original PLM analysis). The other three samples were negative for asbestos in the repeat PLM analysis, just as they were in the initial PLM analyses. Analyses of the other five repeat samples indicated four non-detects and one detect (<1% chrystotile and <1% tremolite) by PLM. These samples were all non-detect in the initial PLM analysis, but four out of five were positive (below the limit of quantitation) by TEM. The results of the TEM analyses for the resampling of the five positive samples was as follows: one sample (Earthgro's Best Vermiculite from MN) had quantifiable asbestos at 0.17%. The TEM result for this product was 0.41% in the initial analysis. Three of the five products with quantifiable asbestos in the initial analysis were positive in the repeat sampling, but had concentrations below the quantification limit. One of the initially positive products was negative when resampled. Some of this variability in results may be the result of the non-uniformity within vermiculite products.

The results of the other three products (VWR laboratory packaging material, Zonolite® from Region 10, and Pursell's Sta-Green, purchased in VA) collected during the second sampling phase showed detectable levels of tremolite in all products using PLM. Quantifiable asbestos levels were

observed in two of these: VWR laboratory packaging material (0.6%) and Zonolite® Chemical Packaging Vermiculite from Region 10 (0.3%). Using TEM, actinolite (and not tremolite) was observed in the VWR laboratory packaging material (0.14%) and Zonolite® from Region 10 (below the quantitation limit).

3.2 SOP 2000

The five positive samples from the initial bulk sample TEM analyses were analyzed by the SOP 2000 method. No detectable asbestos fibers were observed by PLM for any of the samples, and only one sample (Ace Horticultural Grade Vermiculite from MN; 0.24% actinolite by the initial TEM bulk analysis) had detectable actinolite/tremolite below the quantitation limit, based on TEM analyses.

3.3 Superfund Method

The five positive samples from the initial bulk sample TEM analyses were also analyzed by the Superfund Method (EPA, 1997a). The results of these analyses are presented in Table 5. The table presents the quantity (g) of respirable dust generated per gram of bulk sample, as well as the total number of asbestos structures observed per gram of respirable dust. The number of asbestos structures per gram of sample (s/g sample) was calculated by multiplying the respirable dust concentration (g dust/g sample) by the number of asbestos structures per gram of dust (s/g dust). These values are also reported in Table 5. It should be noted that mean concentrations and 95 percent upper confidence limits (UCL) of the mean concentrations were provided by the laboratory. The 95 percent UCL values represent a conservative estimate of the asbestos content of the samples.

The results in Table 5 indicate that, of the five samples that had a quantifiable asbestos content in the initial bulk analyses, only one sample (Schultz Horticultural Vermiculite from Springfield, VA) had quantifiable asbestos structures using the Superfund Method. This sample had 0.13% actinolite, based on the initial bulk TEM analysis, but was non-detect by TEM on resampling. This variability in results could be due to variability in the sample, as well as the analytical technique.

3.4 Consumer Use Simulation

The results of the air sampling inside the containment are presented in Table 6. Outdoor results are presented in Table 7. As shown in Table 6, asbestos fibers were not detected in indoor air (i.e., both area monitors and personal monitors) or outside the containment for 5 of the 7 products, using TEM techniques. These include: Schultz Horticultural Vermiculite purchased in Virginia, Jungle Growth Vermiculite from Florida; Country Cottage Vermiculite from Virginia;

Scott's Vermiculite from Texas; and Kellogg's Vermiculite from California. The Schultz sample was the least "dusty" of the products that were tested inside the containment. No asbestos was observed in indoor air during the simulation using this product although the results of the bulk product analyses for this material using TEM were 0.13% asbestos on initial testing and non-detect on repeat analyses. The Jungle Growth and Kellogg's were both non-detect by both PLM and TEM in the initial bulk analyses. The Country Cottage and Scott's products had non-quantifiable asbestos in the initial bulk TEM analyses. The 2 products with quantifiable asbestos in indoor air were Hoffman's Vermiculite from Minnesota and Zonolite® from Washington. The Hoffman's vermiculite was "dustier" than the Schultz vermiculite, but less dusty than the Zonolite®, Jungle Growth, Country Cottage, and Scott's Vermiculite. The inside air area monitor results for the Hoffman's vermiculite were non-detect using TEM, and ranged from 0.027 to 0.047 f/cc using PCM. PCM and TEM did not detect any fibers in outside monitors. Personal samples during indoor use of Hoffman's vermiculite contained 0.122 to 0.371 f/cc based on PCM, and were non-detect to 0.0935 s/cc (tremolite fibers >5 μm in length) based on TEM. This product had results of 0.7% and BQL asbestos in the bulk TEM analyses. Use of the "dustier" Zonolite® product, resulted in detectable fiber levels in air both outside (0.011 - 0.012 f/cc) and inside (non-detect to 0.108 f/cc) the containment, and in personal monitors (0.344 - 0.482 f/cc) using PCM. Using TEM, the results were non-detect for outside area monitors, non-detect to 0.0769 s/cc actinolite >5 μm in length in indoor area monitors, and 0.4171 to 0.6594 s/cc actinolite >5 μm in length in the personal samples. It should be noted that the Jungle Growth, Country Cottage, and Scott's Products were so "dusty" that the filters in the personal air monitors became overloaded during the 30-minute simulation, and could not be read by PCM. However, for TEM analyses, and indirect preparation method was used in which the filters were ashed and resuspended in water. A fraction of the resuspended sample was then filtered and read by TEM. Asbestos structures were not detected in these samples. However, the detection limits for these samples were high as a result of the required dilution.

Because use of Zonolite® resulted in the highest indoor air fiber concentrations of the three products evaluated, it was used to evaluate fiber concentrations to which consumers could be exposed during outdoor use. The results of this simulation are shown in Table 7. Structures were not detected by TEM, but fibers were observed in both perimeter (0.011 to 0.013 f/cc) and personal (0.134 f/cc) monitors using PCM.

The variability in the PCM and TEM air samples may be due to several factors. PCM counts all visible fibers as asbestos, while TEM distinguishes between asbestos and non-asbestos. TEM is more sensitive than PCM since TEM uses higher magnifications. Some of the TEM samples used an indirect preparation method which can lead to higher numbers of fibers counted due to separation of individual fibers from more complex structures.

All QA/QC samples collected inside and outside prior to product use, as well as field blanks, were negative for asbestos content.

It should be noted that the air concentrations (i.e., 0.094 to 0.66 f/cc) observed in the product use simulation (for those products with detectable levels of asbestos in air) are similar to those estimated in the 1985 Exposure Assessment for Vermiculite (Versar, 1985) (i.e., 0.038 to 0.93 f/cc), which used bulk sample results and simple assumptions to estimate the asbestos concentration in air. For example, the assumptions for use of lawn fertilizers containing vermiculite in the Versar (1985) report were as follows:

- 0.0643 percent of garden fertilizer dispersed into the air during application;
- 15 percent of garden fertilizers was exfoliated vermiculite;
- Exfoliated vermiculite contained 1 percent of asbestos fibers;
- Label application rate was 7,600 g per 465 m^2;
- The average lawn size of 1,010 m^2 was assumed;
- The mid-point of product use would occur at 2 hours for a 4-hour application; and
- Fibers released would remain airborne during application and be evenly distributed in an air volume of 1,010 m^2 x 1.8 m or 1,818 m^3.

The exposure concentration at the mid-point of application was estimated as follows:

$$\text{TWA Exposure Concentration} = \frac{\frac{7{,}600\ \text{g}}{465\ \text{m}^2} * 1{,}010\ \text{m}^2 * 0.15 * 0.01 * 0.000643 * 10^6\ \text{mg/g} * 2\ \text{hours}}{1{,}818\text{m}^3 * 4\ \text{hours}} = 4.4\ \text{mg/m}^3$$

The correlation between PCM fiber counts and TEM mass measurements is very poor. Six data sets, which include both PCM and TEM measurements reported in EPA (2000), show a conversion factor between TEM mass and PCM fibers count that ranges from 5 to 150 ($\mu g/m^3$)/(f/cc). The geometric mean of these results is 30 ($\mu g/m^3$)/(f/cc). Using this conversion factor of 30 ($\mu g/m^3$)/(f/cc), as specified in EPA (2000), this value is equivalent to 0.15 f/cc, and is within the range observed in this study.

3.5 Region 10 Bulk Product Method Using Sieving

The three products that were used in the initial indoor air consumer use simulation (i.e., Hoffman's, Schultz's, and Zonolite®) were also evaluated using the Region 10 bulk product method in which samples were sieved before conducting PLM and TEM. Asbestos was not detected in the fine fraction using both PLM and TEM analyses on whole samples of these products. The sample from the bottom of the bag of Zonolite® indicated only trace asbestos content of the product. Using PLM, tremolite was observed in the fine fraction that passed through the sieves below the quantification limit of 1%. The asbestos content of the original sample, collected from the bottom of the bag, would be <0.19% tremolite, based on this result combined with PLM results for the medium and coarse fractions that showed non-detectable asbestos. Based on TEM, of the fine fraction that passed through the sieves, the asbestos (actinolite/tremolite) content was below the quantification limit of 0.1%. Using the PLM non-detect results for the medium and coarse fractions, the asbestos content of the original sample from the bottom of the bag would equate to <0.02% tremolite/actinolite.

4.0 DISCUSSION

The results of these analyses indicate that some of the consumer products tested contain small amounts of asbestos. As a result, there may be the potential for exposure during consumer product use. Of particular concern is the variability in the bulk sample results. As noted in Table 4, the sample results varied between analytical methods and repeat samples. It is not surprising that samples found to contain asbestos using TEM were non-detect based on PLM because PLM is known to be less sensitive for this type of study. Inconsistencies between the original TEM analysis and repeat TEM analysis are likely as a result of several factors. First, the asbestos content of the products appears to be very close to the detection limit for TEM; thus, even the slightest variability results in some analyses being reported as non-detect or below the quantification limit, while others are slightly above the quantification limit. Also, because only a very small portion of each sample is viewed under the microscope (i.e., 0.01 g), it may be possible to miss asbestos fibers in a product with very low (i.e., <1%) asbestos content. Further variability may occur as a result of the non-homogeneous nature of the product within the bag, bag to bag variability, and differences between the various exfoliating plants and mines that produce vermiculite. In addition, it has been suggested that significant variability in asbestos content can also occur within the same vermiculite mine. Finally, based on the results of the consumer simulation, it appears that the relationship between bulk sample results (i.e., percent asbestos) and indoor air concentrations during use, is not easily quantifiable. This variability may be based on the product characteristics (i.e., moisture content, particle size, or

other factors) or use conditions. Section 5.0 discusses potential risks from exposure to consumer products containing vermiculite based on the results of this study.

5.0 RISK ANALYSIS

The cancer risks from asbestos exposure that are associated with use of vermiculite may be estimated using the personal monitoring results from the product use simulation, either inside the containment or outside, as follows:

$$\text{Risk} = \frac{\text{EC x ET / 24 hrs / day x EF x ED}}{\text{LT x 365 days / yr}} \text{ x URF}$$

where:

EC	=	exposure concentration (f/cc);
ET	=	exposure time (hrs/day);
EF	=	exposure frequency (days/yr);
ED	=	exposure duration (years);
LT	=	lifetime (years); and
URF	=	unit risk factor (0.23 cc/f).

For the purposes of assessing risks to consumers, a range of exposure conditions were assumed. First, the same exposure assumptions as those used in the 1985 Exposure Assessment for Vermiculite (Versar, 1985) were used here (i.e., ET = 4 hours/day; EF = 1 day/year). ED was assumed to be 30 years and LT was assumed to be 75 years (EPA, 1997b). Consumer risks were also calculated using a lower exposure time (i.e., one-half hour per day) and exposure duration (i.e., 10 years) to represent a less conservative scenario, and at a higher exposure frequency (i.e., 6 times per year) to represent more conservative scenarios. The estimated consumer risks based on the fiber concentrations in personal monitors are presented in Table 8 for all products used in the simulations (products with non-detectable asbestos, were assessed at the detection level). The unit risk factor used in the calculations is from EPA's IRIS (EPA, 2000). It should be noted, however, that according to IRIS, this "unit risk factor should not be used if the air concentration exceeds 4E-2 fibers/mL [0.04 f/cc] since above this concentration the slope factor may differ from that stated." However, because this is the only unit risk factor currently available, it was used in this assessment.

For consumers engaging in gardening activities with vermiculite products 4 hours per day, once a year for 30 years with vermiculite products, the risks range from 3.1E-6 to 2.8E-5 (Table 8). The risks are 6 times higher for those engaging in these activities 6 times per year. For consumers

who garden with vermiculite for one-half hour per year for 10 years, the risks ranged from 1.3E-7 to 1.2E-6. The risks are 6 times higher for those engaging in these activities 6 times per year. These risks are based on the air concentrations derived from the indoor and outdoor product use simulations. There are several uncertainties associated with these estimates that should be noted. For example, data on the actual amount of time that the average consumer is likely to handle vermiculite containing asbestos are not available. Therefore, the exposure factors used in this assessment are based on assumptions about the activities of consumers that may or may not accurately reflect actual use patterns. However, the assumptions used are believed to provide a range of risks that would bracket risks among consumers. If consumer exposures/frequencies/durations are 10 to 100 times higher than those assumed here, the corresponding risks to consumers would also be 10 to 100 times higher. It is also possible, that not all of the vermiculite used contains asbestos in the ranges observed in this study. In addition, as mentioned previously, there is some uncertainty associated with the use of the URF for fiber concentrations above 0.04 f/cc. However, given the limited data set, and lack of exposure factors for activities specific to vermiculite use, these risk calculations are believed to represent a reasonable range of estimates for the consumer populations. Occupational exposures were not evaluated as part of this study.

6.0 REFERENCES

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Table 1. Types and Contents of Asbestos Fibers in Vermiculite Produced in the United States*

Mines	Vermiculite Samples	Sample No.	Total Asbestiform Fibers		Respirable Asbestos Fibers				
						IITRI Lab**		ORF Lab***	
			Estimated Contents (%)	Mineral Types	Lab-Exfoliated	x 10^6 Fibers/g	Mass Contents (ppm)	x 10^6 Fibers/g	Mass Contents (ppm)
W.R. Grace Libby, Montana	Head feed (Raw ore)	291-I	21-26	Tremolite-Actinolite	no	62.5	670	131.2	690
	Beneficiated Grade 1	270-I	4-6	Tremolite-Actinolite	no	32.5	78	--	--
	Beneficiated Grade 2	276-I	4-7	Tremolite-Actinolite	yes	23.4	48.5	--	--
	Beneficiated Grade 3	259-I	2-4	Tremolite-Actinolite	yes	42.4	250	59	240
	Beneficiated Grade 4	282-I	0.3-1	Tremolite-Actinolite	yes	65	460	1.8	17
	Beneficiated Grade 5	264-I	2-4	Tremolite-Actinolite	yes	142	2600	160	1800
W.R. Grace Enoree, South Carolina	Mill feed (raw)	436-I	<1	Mixed, Tremo-Actin	no	0.3	0.49	12.3	22
	Beneficiated Grade 3	430-I	<1	Mixed, Tremo-Actin	yes	3.1	3.7	2.4	1.0
	Beneficiated Grade 4	433-I	<1	Mixed, Tremo-Actin	yes	3.1	1.4	2.7	2.0
	Beneficiated Grade 5	427-I	<1	Mixed, Tremo-Actin	yes	3.5	4.1	2.9	120
	Exfoliated Grade 3	439-I	<1	Mixed, Tremo-Actin	--	11.7	--	--	--
	Exfoliated Grade 4	442-I	<1	Mixed, Tremo-Actin	--	--	--	--	--
Patterson, Enoree, South Carolina	Beneficiated Ungraded	573-I	<1	Mixed, Tremo-Actin	yes	0.7	3	1.1	4.0

* Based on Tables 1 and 2 of the MRI report
** Analyzed by Ontario Research Foundation
*** Analyzes by IIT Research Institute

Table 2. Analytical Results of EPA Region 10's Study of Asbestos in Consumer Products

Sample ID	Product	TEM (%)	PLM (%)	Sample Preparation Method
54200	Black Gold Vermiculite	ND	ND	A
54201	Coles Vermiculite	ND	ND	A
54202	Schultz Vermiculite	ND	ND	A
54203	Whitney Farms Vermiculite	ND ND ND	Trace – –	A B C
54204	Scott's Vermiculite	ND ND	Trace Trace	A C
54205	Zonolite® Vermiculite	0.56 (Actinolite) 1.88 (Actinolite/Tremolite) 0.10 (Tremolite)	– – –	A B C
54206	Zonolite® Vermiculite	0.47 (Actinolite) 2.79 (Tremolite)	Trace –	A C
104200	Zonolite® Chubby & Tubby	ND	–	B
54207	Termo-O-Rock	ND 0.33 (Actinolite) 0.30 (Tremolite)	Trace – –	A B C
54208	Professional Jiffy Mix Potting Soil	ND	ND	A
54209	Sam's Choice Professional Potting Soil	ND	ND	A
54210	Coles Lighthouse Plant Mix	ND	ND	A
54211	Schultz Seed Starter	ND	ND	A
54212	Schultz Seed Starter	ND	ND	A
54213	Coles African Violet Mix	ND	ND	A
54214	Coles Cactus Mix	0.45 (Actinolite)	ND	A
54215	Country Cottage Professional Seed Starter	ND	ND	A
54216	Black Gold Seedling Mix	ND	ND	A
54217	Scotts Progro Professional Potting Mix	ND	ND	A

Notes:

ND = Non-detect.

A = Representative sample from cross section of bag. Analyses done by semi-quantitative PLM and TEM method: EPA/600/R-93/116.

B = Sample sifted with USA Standard Testing Seives (size No. 10 and No. 35). Analyses done using semi-quantitative method: EPA/600/R-93/116. Results represent asbestos content of only the fine portion (i.e., the portion that passed through the sieves) of vermiculite product; does not represent percent asbestos in whole product.

C = Residue after particle separation from Manchester Environmental Laboratory (MEL). Analysis done using semi-quantitative method: EPA/600/R-93/116. Results represent asbestos content of only the fine portion (i.e., the portion that passed through the sieves) of vermiculite product; does not represent percent asbestos in whole product (see Section 1.1 for details on this procedure).

Table 3. Vermiculite or Vermiculite-Containing Products Purchased

Location of Purchase	Product Name
Tempe, Arizona	Black Gold Vermiculite Whitney Farms Vermiculite Whitney Farms African Violet Mix
Sacramento, California	Black Gold Vermiculite Green-all Vermiculite Unigro Premium Organic Vermiculite Kellogg's Vermiculite
Denver (Northglen), Colorado	Schultz Professional Potting Soil Schultz Horticultural Vermiculite Cole's Houseplant mix Cole's Premium Vermiculite Cole's Premium African Violet Mix
Miami, Florida	Jungle Growth Vermiculite Ace Horticultural Grade Vermiculite OFE International Inc. Bromeliad Mix Ferti-lome Vermiculite Schultz Horticultural Vermiculite Jungle Growth African Violet Mix
Atlanta, Georgia (mail order)	Ben Meadows Palmetto Lab Pack
Chicago (Lombard), Illinois	Mica Grown Vemiculite
Minneapolis (Hopkins), Minnesota	Miracle Gro Vermiculite Hoffman's Vermiculite Ace Horticultutal Grade Vermiculite Earthgro's Best Vermiculite Country Cottage Vermiculite
Philadelphia (Bristol), Pennsylvania	Hoffman's African Violet mix Butterfield Farms Potting Soil Premier Pro-mix
San Antonio, Texas	Scott's Vermiculite Professional Jiffy Mix
Springfield, Virginia (Washington, DC area)	Schundler Horticultual Vermiculite Care Free Jiffy Mix Schultz Horticultural Vermiculite Country Cottage Horticultural Vermiculite Pursell's Stay-Green Vermiculite
Kent, Washington	Zonolite® Chemical Packaging Vermiculite (purchased by Versar) Zonolite® Chemical Packaging Vermiculite (purchased by Region 10)
Batavia, Illinois	VWR Lab Packaging Material[a]

a VWR is a user of this lab packaging material and is not the distributor of this material. The original source of this packaging material is unknown.

Table 4. Analytical Results

Sample ID	Purchase Location	Brand	Product	Bulk Analyses				SOP 2000			Superfund Method		Region 10 Sieving Method	
				PLM Results (weight %)	PLM Fiber Type Observed	TEM Results (weight %)	TEM Fiber Type Observed	PLM Results (weight %)	TEM Results (weight %)	TEM Fiber Type Observed	Releasable Long (>5 μm) Asbestos Structures/g Samples			
											Mean	95% UCL	PLM (weight %)	TEM (weight %)
90812	Miami, FL	Jungle Growth	Vermiculite	ND (2)	--	ND	--	NA	NA	--	NA (4)	NA	--	--
90813	Miami, FL	Ace	Horticultural Grade Vermiculite	ND		0.35	Actinolite	ND	ND	--	<369	<724	--	--
68184	(resample)			ND	--	BQL (3)	Actinolite							
90814	Miami, FL	OFE International Inc.	Bromeliad Mix (1)	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90815	Miami, FL	Ferti-lome	Vermiculite	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90816	Miami, FL	Schultz	Horticultural Vermiculite	ND	--	BQL	Actinolite	NA	NA	--	NA	NA	--	--
68189	(resample)			ND	--	ND	--							
90817	Miami, FL	Jungle Growth	African Violet Mix (1)	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90818	Temp, AZ	Black Gold	Vermiculite	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90819	Temp, AZ	Whitney Farms	Vermiculite	ND	--	BQL	Actinolite	NA	NA	--	NA	NA	--	--
90820	Temp, AZ	Whitney Farms	African Violet Mix (1)	ND	--	BQL	Actinolite/ Chrysotile	NA	NA	--	NA	NA	--	--
68191	(resample			ND	--	ND								
90821	Sacramento, CA	Black Gold	Vermiculite	ND	--	BQL	Chrysotile	NA	NA	--	NA	NA	--	--
68190	(resample)			BQL	Chrysotile/ Tremolite	ND	--							
90822	Sacramento, CA	Green-All	Vermiculite	ND	--	BQL	Actinolite	NA	NA	--	NA	NA	--	--
90823	Sacramento, CA	Unigro	Premium Organic Vermiculite	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90824	Sacramento, CA	Kellogg's	Vermiculite	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90825	Northglen, CO	Schultz	Professional Potting Soil (1)	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90826	Northglen, CO	Schultz	Horticultural Vermiculite	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90827	Northglen, CO	Cole's	Houseplant Mix (1)	ND	--	ND	--	NA	NA	--	NA	NA	--	--

Table 4. Analytical Results (continued)

Sample ID	Purchase Location	Brand	Product	Bulk Analyses				SOP 2000			Superfund Method		Region 10 Sieving Method	
				PLM Results (weight %)	PLM Fiber Type Observed	TEM Results (weight %)	TEM Fiber Type Observed	PLM Results (weight %)	TEM Results (weight %)	TEM Fiber Type Observed	Releasable Long (>5 μm) Asbestos Structures/g Samples			
											Mean	95% UCL	PLM (weight %)	TEM (weight %)
90828	Northglen, CO	Cole's	Premium Vermiculite	ND	--	BQL	Chrysotile	NA	NA	--	NA	NA	--	--
90829	Northglen, CO	Cole's	Premium African Violet Mix (1)	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90830	Hopkins, MN	Miracle Gro	Vermiculite	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90831	Hopkins, MN	Hoffman's	Vermiculite	ND	--	0.70	Actinolite	ND	ND	--	<241	<472	ND	ND
68185	(resample)			BQL	Tremolite	BQL	Anthophyllite							
68183	Hopkins, MN	Hoffman's (bottom of bag)	Vermiculite	BQL	Tremolite	BQL	Actinolite	NA	NA	--	NA	NA	--	--
90832	Hopkins, MN	Ace	Horticultural Grade Vermiculite	ND	--	0.24	Actinolite	ND	BQL	Actinolite/ Tremolite	<380	<745	--	--
68186	(resample)			ND	--	BQL	Actinolite							
90833	Hopkins, MN	Earthgro's	Best Vermiculite	ND	--	0.41	Actinolite	ND	ND	--	<414	<811	--	--
68187	(resample)			BQL	Tremolite	0.17	Actinolite							
90834	Hopkins, MN	Country Cottage	Vermiculite	ND	--	ND	--	ND	ND	--	--	--	--	--
90835	Lombard, IL	Mica Grown	Vermiculite	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90836	Bristol, PA	Hoffman's	African Violet Soil Mix (1)	ND	--	BQL	Actinolite/ Chrysotile	NA	NA	--	NA	NA	--	--
68193	(resample)			ND	--	BQL	Actinolite							
90837	Bristol, PA	Butterfield Farms	Potting Soil (1)	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90838	Bristol, PA	Premier	Pro-mix (1)	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90839	San Antonio, TX	Scott's	Vermiculite	ND	--	ND	--	NA	NA	--	NA	NA	--	--
68192	(resample)			ND	--	BQL	Actinolite							
90840	San Antonio, TX	Professional	Jiffy Mix (1)	ND	--	ND	--	NA	NA	--	NA	NA	--	--
90841	Atlanta, GA	Ben Meadows Palmetto	Lab Pack	ND	--	BQL	Chrysotile	NA	NA	--	NA	NA	--	--
90842	Springfield, VA	Schundler	Horticultural Vermiculite	ND	--	BQL	Chrysotile	NA	NA	--	NA	NA	--	--

Table 4. Analytical Results (continued)

Sample ID	Purchase Location	Brand	Product	Bulk Analyses				SOP 2000			Superfund Method		Region 10 Sieving Method	
				PLM Results (weight %)	PLM Fiber Type Observed	TEM Results (weight %)	TEM Fiber Type Observed	PLM Results (weight %)	TEM Results (weight %)	TEM Fiber Type Observed	Releasable Long (>5 μm) Asbestos Structures/g Samples			
											Mean	95% UCL	PLM (weight %)	TEM (weight %)
90843	Springfield, VA	Care Free	Jiffy Mix (1)	ND	--	BQL	Actinolite/ Chrysotile	NA	NA	--	NA	NA	--	--
90844	Springfield, VA	Schultz	Horticultural Vermiculite	ND	--	0.13	Actinolite	NA	NA	--	424	832	ND	ND
68188	(resample)			ND	--	ND	--							
90845	Springfield, VA	Country Cottage	Horticultural Vermiculite	ND	--	BQL	Chrysotile	NA	NA	--	NA	NA	--	--
90846	Kent, WA	Zonolite® (bottom of bag)	Chemical Packaging	ND	--	BQL	Actinolite	NA	NA	--	NA	NA	BQL <1%	BQL <0.1%
90847	Kent, WA	Zonolite® (composite sample)	Chemical Packaging	ND	--	ND	--	NA	NA	--	NA	NA	ND	ND
68180	Batavia, IL (provided by EPA)	VWR (5)	Lab Packaging	0.6	Tremolite	0.14	Actinolite	NA	NA	--	NA	NA	--	--
68181	Kent, WA (provided by Region 10)	Zonolite® (sample from bottom 1/3 of bag)	Chemical Packaging	0.3	Tremolite	BQL	Actinolite	NA	NA	--	NA	NA	--	--
68182	Springfield, VA	Pursell's	Sta-Green	BQL	Tremolite	ND	--	NA	NA	--	NA	NA	--	--

(1) Ashed due to organic content.
(2) ND = Not detected.
(3) BQL = Below Quantitation limit (0.25% for PLM and 0.1% for TEM).
(4) NA = Not analyzed.
(5) VWR is a user of this lab packaging material and is not the distributor of this material. The original source of this packaging material is unknown.

Table 5. Results of Asbestos Analyses Using EPA Superfund Method

Sample ID	Purchase Location	Brand	Product	Respirable Dust Conc. (g dust/g sample)	Total Asbestos Concentration (s/g dust)[a]		Long Asbestos Concentration (s/g dust)[a]		Total Asbestos Concentration (s/g sample)[b]		Long (>5 μg) Asbestos Concentration (s/g sample)[b]	
					Mean	95% UCL	Mean	95% UCL	Mean	95% UCL	Mean	95% UCL
90813	Miami, FL	Ace	Horticultural Grade Vermiculite	2.52E-6	<1.47E+8	<2.88E+8	<1.47E+8	<2.88E+8	<369	<724	<369	<724
90831	Hopkins, MN	Hoffman's	Vermiculite	9.54E-7	<2.52E+8	<4.95E+8	<2.52E+8	<4.95E+8	<241	<472	<241	>472
90832	Hopkins, MN	Ace	Horticultural Grade Vermiculite	6.63E-7	<5.74E+8	<1.12E+9	<5.74E+8	<1.12E+9	<380	<745	<380	<745
90833	Hopkins, MN	Earthgro's	Best Vermiculite	1.31E-7	<3.16E+9	<6.19E+9	<3.16E+9	<6.19E+9	<414	<811	<414	<811
90844	Springfield, VA	Schultz	Horticultural Vermiculite	2.93E-6	2.18E+8	4.27E+8	1.45E+8	2.84E+8	637	1,249	424	832

a Structures per gram of dust.
b Structures per gram of sample.

Table 6. Fiber Levels in Air Inside the Containment

Product/Purchase Location	Monitor Location	PCM Concentration[a] (f/cc) NIOSH 7400 Method	TEM Concentration[b] (s/cc) EPA Level II Method	TEM Fiber Type
Schultz Horticultural Vermiculite Springfield, VA (ND - 0.13% asbestos, based on TEM on bulk samples)	Outside area monitor	<0.008	ND (<0.0176)	–
	Inside area monitor	<0.008 - 0.015	ND (<0.0176)	–
	Personal monitor	<0.043	ND (<0.1002)	–
Hoffman's Vermiculite Hopkins, MN (BQL - 0.70% asbestos, based on TEM on bulk samples)	Outside area monitor	<0.008	ND (<0.0176)	–
	Inside area monitor	0.027 - 0.047	ND (<0.0178)	–
	Personal monitor	0.122 - 0.371	ND (<0.1047) - 0.0935	Tremolite >5 μm in length
Zonolite® Chemical Packaging Vermiculite Kent, WA (ND - BQL asbestos, based on TEM on bulk samples)	Outside area monitor	0.011 - 0.012	ND (<0.0167)	–
	Inside area monitor	<0.010 - 0.108	ND (<0.0229) - 0.0961 ND (<0.0229) - 0.0769	Actinolite all fiber lengths Actinolite >5 μm in length
	Personal monitor	0.344 - 0.482	0.6255 - 0.7536 0.4170 - 0.6594	Actinolite all fiber lengths Actinolite >5 μm in length
Country Cottage Horticultural Vermiculite Springfield, VA (BQL Asbestos, based on TEM on bulk sample)	Outside area monitor	0.008 - 0.012	ND (<0.0151)	-
	Inside area monitor	overloaded	ND (<0.5012)[c]	-
	Personal monitor	overloaded	ND (<3.4302)[c]	-
Scott's Vermiculite San Antonio, TX (ND-BQL asbestos, based on TEM on bulk samples)	Outside area monitor	<0.006	ND (<0.0141)	-
	Inside area monitor	overloaded	ND (<2.5044)[c]	-
	Personal monitor	overloaded	ND (<16.0428)[c]	-
Jungle Growth Vermiculite Miami, FL (ND asbestos, based on TEM on bulk sample)	Outside area monitor	0.014 - 0.015	ND (<0.0151)	-
	Inside area monitor	overloaded	ND (<1.0028)[c]	-
	Personal monitor	overloaded	ND (<3.2868)[c]	-
Kellogg's Vermiculite Sacramento, CA (ND asbestos, based on TEM on bulk sample)	Outside area monitor	<0.006	ND (<0.0151)	-
	Inside area monitor	0.017 - 0.020	ND (<0.0149)	-
	Personal monitor	< 0.047 - 0.074	ND (<0.1052)	-

Note:

f/cc = fibers per cubic centimeter
s/cc = structures per cubic centimeter

ND = non-detect (detection limit)

[a] All fibers meeting the counting rules; 3:1 ratio; >5 μm in length.
[b] Asbestos structures.
[c] Sample was analyzed by indirect prep., ash and resuspended, 2 to 10% of sample filtered for analyses.

Table 7. Fiber Levels in Outside Air

Product/Purchase Location	Monitor Location	PCM Concentration[a] (f/cc) NIOSH 7400 Method	TEM Concentration[b] (s/cc) EPA Level II Method	TEM Fiber Type
Zonolite® for Horticultural Use Kent, WA (ND - BQL asbestos, based on TEM on bulk samples)	Perimeter	0.011 - 0.013[c]	ND (<0.0155)	–
	Personal	0.134[c]	ND (<0.0718)	--

Note:

f/cc = fibers per cubic centimeter
s/cc = structures per cubic centimeter

[a] All fibers meeting the counting rules; 3:1 ratio; >5 μm in length.
[b] Asbestos structures.
[c] One sample was overloaded with dust and could not be read.

Table 8. Estimated Cancer Risks from Asbestos Associated with Consumer Use of Vermiculite

	EC (f/cc)	Risk at ET = 4 EF = 1 EF = 30 LT = 75 URF = 0.23	Risk at ET = 0.5 EF = 1 EF = 10 LT = 75 URF = 0.23	Risk at ET = 4 EF = 6 EF = 30 LT = 75 URF = 0.23	Risk at ET = 0.5 EF = 6 EF = 10 LT = 75 URF = 0.23
Indoor Use					
Schultz's Vermiculite					
PCM	<0.04	<1.7E-6	<7.0E-8	<1.0E-5	<4.2E-7
TEM[a]	<0.10	<4.2E-6	<1.8E-7	<2.5E-5	<1.1E-6
Hoffman's Vermiculite					
PCM	0.37	1.6E-5	6.5E-7	9.3E-5	3.9E-6
TEM[a]	0.094	3.9E-6	1.6E-7	2.4E-5	9.9E-7
Zonolite®					
PCM	0.48	2.0E-5	8.4E-7	1.2E-4	5.0E-6
TEM[a]	0.66	2.8E-5	1.2E-6	1.7E-4	6.9E-6
Country CottageVermiculite					
PCM	-	-	-	-	-
TEM[a]	<3.4	b	b	b	b
Scott's					
PCM	-	-	-	-	-
TEM[a]	<16.0	b	b	b	b
Jungle Growth					
PCM	-	-	-	-	-
TEM[a]	<3.3	b	b	b	b
Kellogg's					
PCM	0.074	3.1E-6	1.3E-7	1.9E-5	7.8E-7
TEM[a]	<0.11	<4.6E-6	<1.9E-7	<2.8E-5	<1.2E-6
Outdoor Use					
Zonolite®					
PCM	0.13	5.5E-6	2.3E-7	3.3E-5	1.4E-6
TEM[a]	<0.072	<3.0E-6	<1.3E-7	<1.8E-5	<7.6E-7

a Fibers >5 μm in length.

b Risk not calculated because concentration term was non-detect with a high detection limit resulting from dilution of the sample.

Note: Risk = [(EC x (ET/24 hr/day) x EF x ED) / (LT x 365 d/yr)] x URF

EC = exposure concentration (f/cc)
ET = exposure time (hr/day)
EF = exposure frequency (days/yr)
ED = exposure duration (years)
LT = lifetime (years)
URF= unit risk factor (cc/c)

Figure 1. Zonolite® Sample Purchased from Kent, Washington

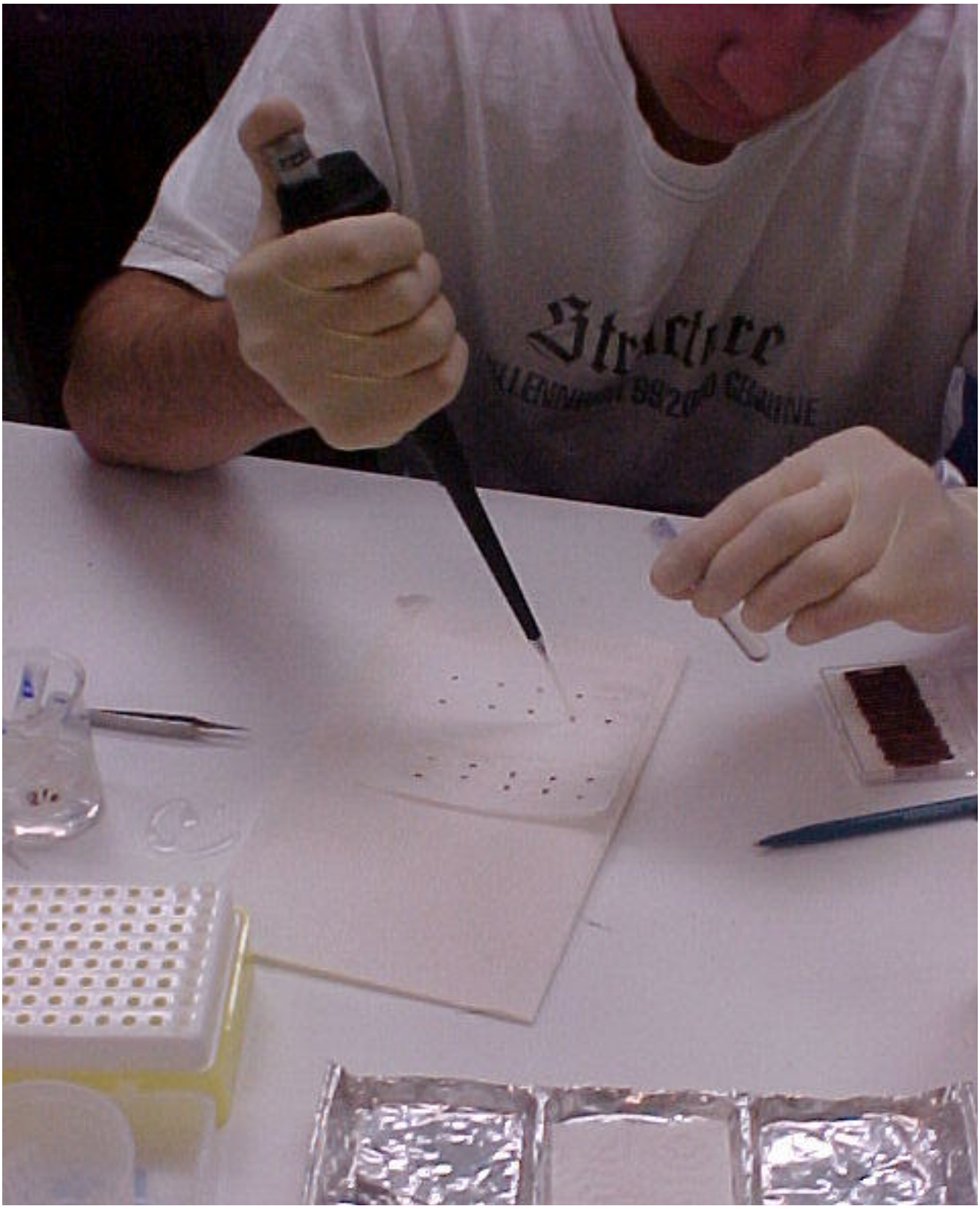

Figure 2. Preparation of TEM Grids

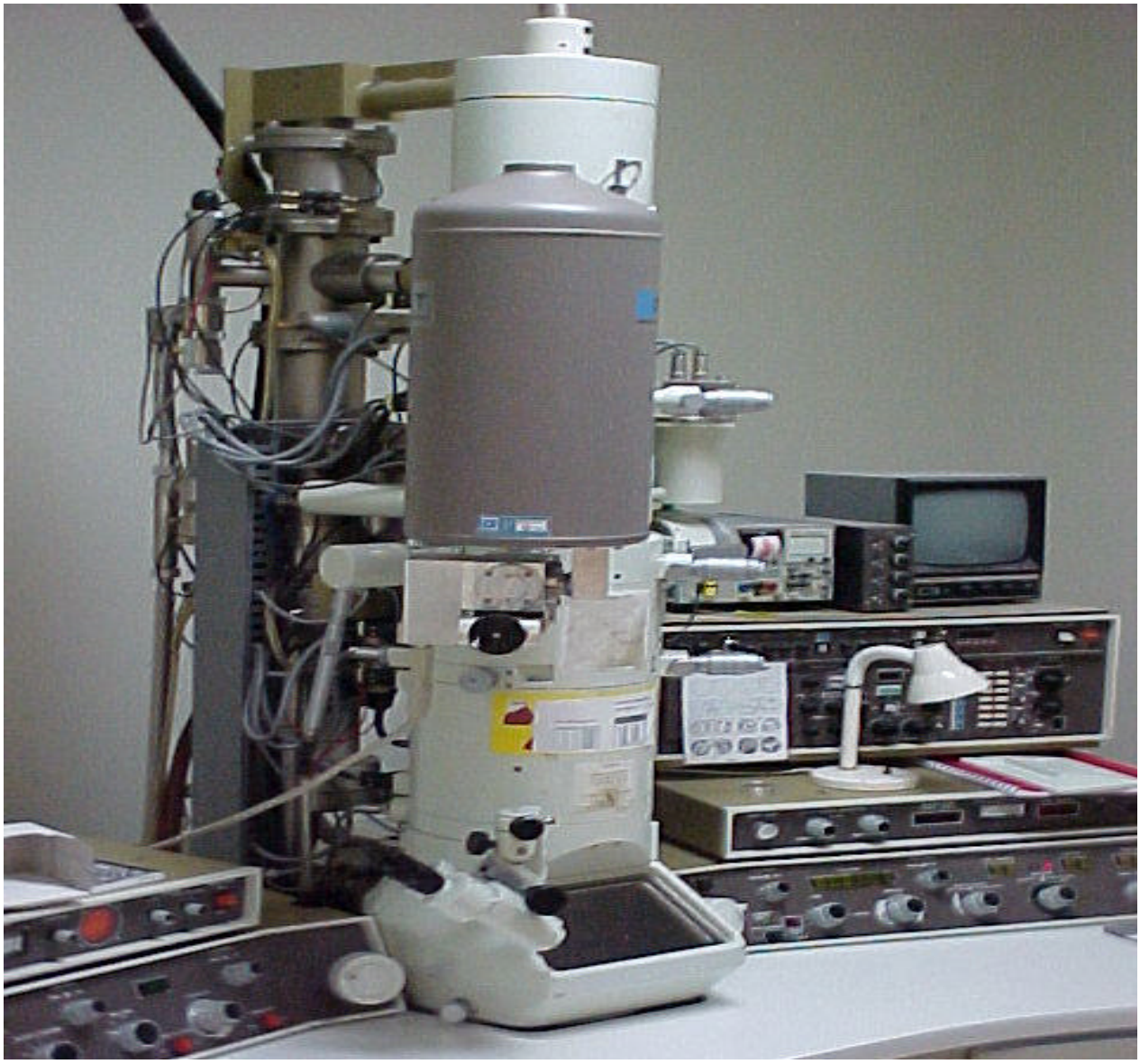

Figure 3. Transmission Electron Microscpe

Figure 4. Elutriator Used in the Superfund Method

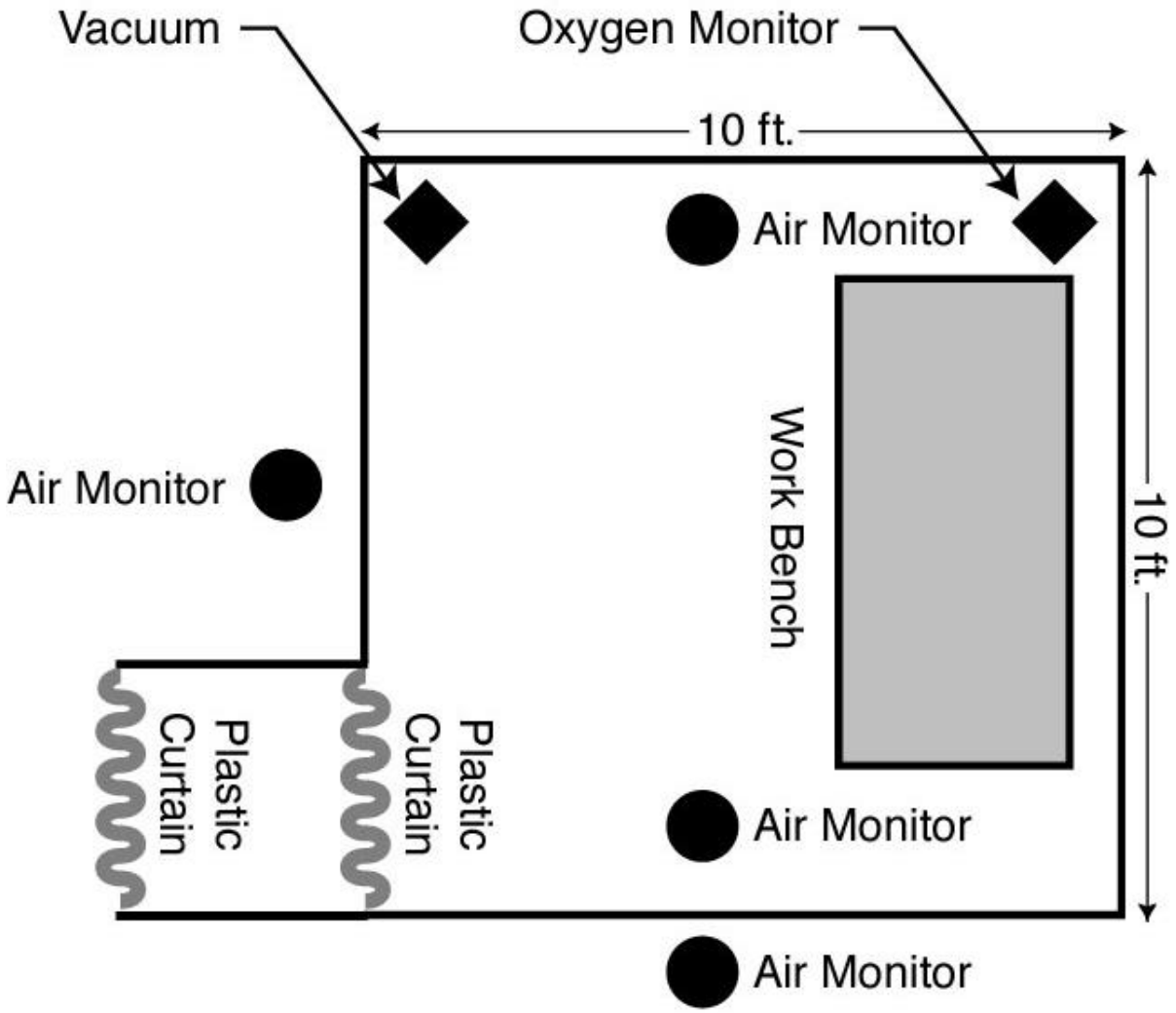

Figure 5. Diagram of 10' x 10' x 10' Containment Used in the Product Use Simulation

Figure 6. Containment Used in Product Use Simulation

Figure 7. Consumer Use Simulation Wearing Protective Clothing

Figure 8. High-Volume Air Sampling Pump

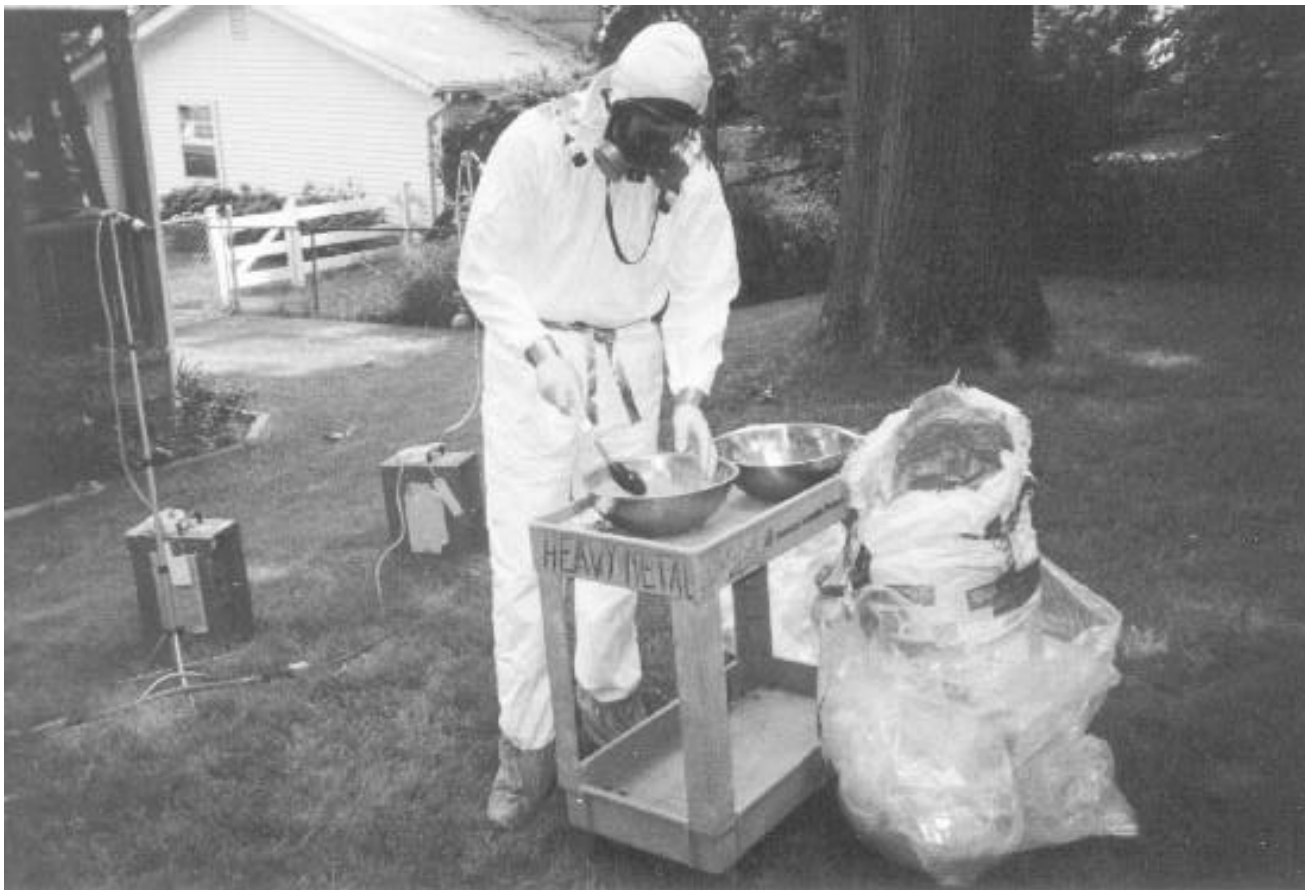

Figure 9. Outdoor Product Use Simulation

Figure 10. Sieving the Vermiculite Product

Figure 11. Asbestos Fiber Seen by TEM

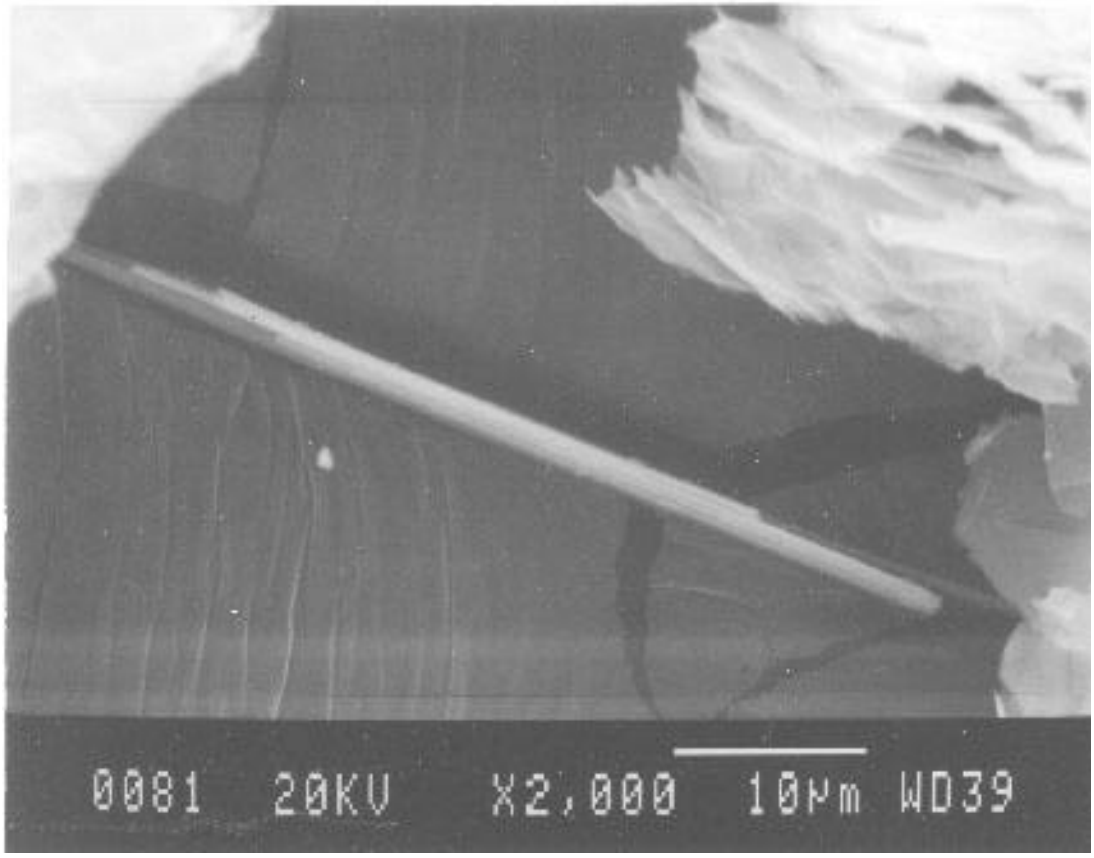

Figure 12. Actinolite Asbestos Fiber

APPENDIX A

Laboratory Reports

EMSL Analytical, Inc
107 Haddon Avenue, Westmont, NJ 08108 TEL: 856-858-4800

Attn: David Nelson
Versar Inc.
P.O. Box 1549
6850 Versar Center
Springfield, VA 22151
Fax: 703-642-6942 Phone: 703-750-3000 ext. 6946
Project: EPA Vermiculite/4600.008

Customer ID: VERS96
Customer PO:
Received: 4/17/00

EMSL Order: 040005712

Analysis of Vermiculite Asbestos by Transmission Electron Microscopy

Sample ID	*Asbestos Weight%*	*Asbestos Type(s)*	*Ashed / Not Ashed*
90812	BQL	ND	
90813	0.35 *Weight %*	Actinolite	
90814	BQL	ND	Ashed
90815	BQL	ND	
90816	BQL	Actinolite	
90817	BQL	ND	Ashed
90818	BQL	ND	
90819	BQL	Actinolite	
90820	BQL	Actinolite/ Chrysotile	Ashed
90821	BQL	Chrysotile	
90822	BQL	Actinolite	
90823	BQL	ND	
90824	BQL	ND	
90825	BQL	ND	Ashed
90826	BQL	ND	
90827	BQL	ND	Ashed
90828	BQL	Chrysotile	
90829	BQL	ND	Ashed
90830	BQL	ND	
90831	0.7 *Weight %*	Actinolite	
90832	0.24 *Weight %*	Actinolite	
90833	0.41 *Weight %*	Actinolite	
90834	BQL	ND	
90835	BQL	ND	
90836	BQL	Actinolite/Chrysotile	Ashed
90837	BQL	ND	Ashed
90838	BQL	ND	Ashed
90839	BQL	ND	
90840	BQL	ND	Ashed
90841	BQL	Chrysotile	
90842	BQL	Chrysotile	
90843	BQL	Actinolite/Chrysotile	Ashed

Key
BQL = Below Quantitation Limit (about 0.1 weight%)
ND = None Detected

A.V. Samudra, Ph.D.

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Attn: Bradley Norton
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **4600.008/EPA Vermiculite**

Customer ID VERS96
Customer PO:
Received: 04/14/00 1:16 PM

EMSL Order: 040005712
EMSL Project ID:

Polarized Light Microscopy (PLM) - Point Count Performed by EPA 600/M4-82-020/ELAP 5.2.1-6.0 Methods*

				Asbestos	Non-Asbestos	
Sample	Location	Appearance	Treatment	% Type	% Fibrous	% Non-Fibrous
90812 *040005712-0001*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90813 *040005712-0002*		Grayish/Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90814 *040005712-0003*		Brown/Tan Fibrous Heterogeneous	Teased	**None Detected**	30.0% Cellulose 1.0% Synthetic	69.0% Non-fibrous (other)
90815 *040005712-0004*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90816 *040005712-0005*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90817 *040005712-0006*		Brown/Tan/Gray Fibrous Heterogeneous	Teased	**None Detected**	30.0% Cellulose <1% Glass 1.0% Synthetic	69.0% Non-fibrous (other)
90818 *040005712-0007*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90819 *040005712-0008*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90820 *040005712-0009*		Brown/Gray Fibrous Heterogeneous	Teased Dissolved	**None Detected**	55.0% Cellulose 3.0% Wollastonite	42.0% Non-fibrous (other)
90821 *040005712-0010*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90822 *040005712-0011*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)

Scott Combs
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: PLM has been known to miss asbestos in a small percentage of samples which contain asbestos. Thus negative PLM results cannot be guaranteed. Samples reported as <1% or none detected should be tested with either SEM or TEM. The above test report relates only to the items tested. This report may only be reproduced in part with written approval by EMSL. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. All "NVLAP" reports with NVLAP logo must contain at least one signature to be valid. Laboratory is not responsible for the accuracy of results when requested to physically separate and analyze layered samples.

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Attn:	Bradley Norton Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID	VERS96
		Customer PO:	
		Received:	04/14/00 1:16 PM
Fax:	703-642-6809 Phone: 703-642-6889	EMSL Order:	040005712
Project:	**4600.008/EPA Vermiculite**	EMSL Project ID:	

Polarized Light Microscopy (PLM) - Point Count Performed by EPA 600/M4-82-020/ELAP 5.2.1-6.0 Methods*

Sample	Location	Appearance	Treatment	Asbestos % Type	Non-Asbestos % Fibrous	% Non-Fibrous
90823 *040005712-0012*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90824 *040005712-0013*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90825 *040005712-0014*		Brown/Tan Fibrous Heterogeneous	Teased	**None Detected**	70.0% Cellulose <1% Synthetic	30.0% Non-fibrous (other)
90826 *040005712-0015*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90827 *040005712-0016*		Brown/Gray/Tan Fibrous Heterogeneous	Teased	**None Detected**	50.0% Cellulose <1% Synthetic 3.0% Wollastonite	47.0% Non-fibrous (other)
90828 *040005712-0017*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90829 *040005712-0018*		Brown/Gray/Tan Fibrous Heterogeneous	Teased Dissolved	**None Detected**	50.0% Cellulose <1% Synthetic 3.0% Wollastonite	47.0% Non-fibrous (other)
90830 *040005712-0019*		Gold/Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90831 *040005712-0020*		Brown/Gold Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90833 *040005712-0021*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90834 *040005712-0022*		Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)

Scott Combs
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: PLM has been known to miss asbestos in a small percentage of samples which contain asbestos. Thus negative PLM results cannot be guaranteed. Samples reported as <1% or none detected should be tested with either SEM or TEM. The above test report relates only to the items tested. This report may only be reproduced in part with written approval by EMSL. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. All "NVLAP" reports with NVLAP logo must contain at least one signature to be valid. Laboratory is not responsible for the accuracy of results when requested to physically separate and analyze layered samples.

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Attn: Bradley Norton
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **4600.008/EPA Vermiculite**

Customer ID VERS96
Customer PO:
Received: 04/14/00 1:16 PM

EMSL Order: 040005712
EMSL Project ID:

Polarized Light Microscopy (PLM) - Point Count Performed by EPA 600/M4-82-020/ELAP 5.2.1-6.0 Methods*

				Asbestos	Non-Asbestos	
Sample	**Location**	**Appearance**	**Treatment**	**% Type**	**% Fibrous**	**% Non-Fibrous**
90832 *040005712-0023*		Gold/Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90835 *040005712-0024*		Tan/Gold Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90836 *040005712-0025*		Brown/Gold Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90837 *040005712-0026*		Brown/Black/Gray Fibrous Heterogeneous	Teased	**None Detected**	10.0% Cellulose 1.0% Hair <1% Synthetic	89.0% Non-fibrous (other)
90838 *040005712-0027*		Brown Fibrous Heterogeneous	Teased	**None Detected**	40.0% Cellulose <1% Synthetic	60.0% Non-fibrous (other)
90839 *040005712-0028*		Gold/Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90840 *040005712-0029*		Brown/Tan Fibrous Heterogeneous	Teased	**None Detected**	60.0% Cellulose <1% Synthetic	40.0% Non-fibrous (other)
90841 *040005712-0030*		Grayish/Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90842 *040005712-0031*		Gold/Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100.0% Non-fibrous (other)
90843 *040005712-0032*		Brown/Tan/Gold Fibrous Heterogeneous	Teased	**None Detected**	70.0% Cellulose <1% Synthetic	30.0% Non-fibrous (other)

Scott Combs
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: PLM has been known to miss asbestos in a small percentage of samples which contain asbestos. Thus negative PLM results cannot be guaranteed. Samples reported as <1% or none detected should be tested with either SEM or TEM. The above test report relates only to the items tested. This report may only be reproduced in part with written approval by EMSL. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. All "NVLAP" reports with NVLAP logo must contain at least one signature to be valid. Laboratory is not responsible for the accuracy of results when requested to physically separate and analyze layered samples.

TEM BULK EPA 600/93/116 AND | PLM POINT COUNT | 6 TO 10 Day

4600

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE Y / N
4600.008	EPA VERMICULITE		

SAMPLERS: (Signature) [signature] [signature]

(Printed) DAVID A. NELSON, BRADLEY T. NORTON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PER SHIPPING INVOICE AND P.O. # 04643	REMARKS
90812	4/12/00				JUNGLE GROWTH VERMICULITE	1		MIAMI, FLA
90813					HORTICULTURAL GRADE VERMICULITE - ACE BRAND			
90814					BROMELIAD MIX-OFF INTERNATIONAL INC.			
90815					FERTI-LOME-VERMICULITE			
90816					SCHULTZ HORTICULTURAL VERMICULITE			
90817					JUNGLE GROWTH-AFRICAN VIOLET MIX			
90818					BLACK GOLD VERMICULITE			TEMPE, ARIZONA
90819					WHITNEY FARMS-VERMICULITE			
90820					WHITNEY FARMS AFRICAN VIOLET MIX			
90821					BLACK GOLD-VERMICULITE			SACRAMENTO, CA
90822					GREEN ALL-VERMICULITE			
90823	↓				PREMIUM ORGANIC VERMICULITE-GREEN GRO	↓		

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	4/12/00 1700				
(Printed) DAVID A. NELSON	4/12/00 1700	(Printed)	(Printed)		(Printed)
Relinquished by: (Signature)	**Date / Time**	**Received for Laboratory by:** (Signature)	**Date / Time**	**Remarks**	
(Printed)		(Printed)		PLEASE SEE DR. FRASCA CONCERNING ANALYSIS	

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink)

4601

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE Y / N
4600.008	CDA VERMICULITE		

SAMPLERS: *(Signature)* [signatures] (Printed) DAVID A. NELSON / BRADLEY J. HORTON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PER SUITE OF WORK ASSIGNMENT	REMARKS
90824	4/12/00				KELLOGG'S VERMICULITE	1		SACRAMENTO, CA
90825					SCHULTZ PROFESSIONAL POTTING SOIL			NORTHGLENN, CO
90826					SCHULTZ HORTICULTURAL VERMICULITE			
90827					COLE'S LITE HOUSEPLANT MIX			
90828					COLE'S PREMIUM VERMICULITE			
90829					COLE'S PREMIUM AFRICAN VIOLET MIX			
90830					MIRACLE GRO VERMICULITE			HOPKINS, MN
90831					HOFFMAN VERMICULITE			
90833					CARTHAGO'S BEST VERMICULITE			
90834					COUNTRY COTTAGE VERMICULITE			
90832					ACE HORTICULTURAL GRADE VERMICULITE			
90835	↓				MICA GROUP VERMICULITE	↓		LOMBARD, IL

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
[signature]	4/12/00 1100				
(Printed) DAVID A. NELSON	4/12/00 1700	(Printed)	(Printed)		(Printed)

Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks
				PLEASE SEE DR. FRASCO CONCERNING ANALYSIS
(Printed)		(Printed)		

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink)

APR 14 PM 1:16

4602

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE Y / N
4600.008	CDA VERMICULITE		

SAMPLERS: (Signature) [signature] (Printed) DAVID A. NELSON / BRADLEY J. HORTON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PER Work Plan Work Assignment No. 03763	REMARKS
90836	4/11/00				HOFFMAN AFRICAN VIOLET SOIL MIX	1		BEISTEL PPA
90837					BUTTERFIELD FARMS POTTING SOIL			
90838					PREMIER PRO-MIX			
90839					SCOTTS VERMICULITE			SAL AUSTIN, TX
90840					PROFESSIONAL JIFFY MIX			
90841					LAB PACK - BEN MEADOWS - PALMETTO BARK			SPRINGFIELD, VA
90842					SCHUNDLER HORTICULTURAL VERMICULITE			
90843	↓				CARE FREE JIFFY MIX	↓		↓

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	4/12/00 1700				
(Printed) DAVID A. NELSON	4/12/00 1700	(Printed)	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
(Printed)		(Printed)		PLEASE SEE DR. FRASCA CONCERNING ANALYSIS

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink)

EMSL Analytical, Inc
107 Haddon Avenue, Westmont, NJ 08108 TEL: 856-858-4800

Attn: David Nelson
Versar Inc.
6850 Versar Center
P.O. Box 1549
Springfield, VA 22151
Fax: 703-642-6942 Phone: 703-750-3000 ext. 6946
Project: EPA Vermiculite/4600.008

Customer ID: VERS96
Customer PO:

Received: 4/14/00

EMSL Order: 040005817

Analysis of Vermiculite Asbestos by Transmission Electron Microscopy

Sample ID	*Asbestos Weight%*	*Asbestos Type(s)*	*Ashed / Not Ashed*
90844	0.13 Weight%	Actinolite	Not Ashed
90845	BQL	Chrysotile	Not Ashed
90846	BQL	Actinolite	Not Ashed
90847	BQL	ND	Not Ashed

Key
BQL = Below Quantitation Limit (about 0.1 wt%)
ND = None Detected

A.V. Samudra

A.V. Samudra, Ph.D.

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **EPA Vermiculite/4600.008**

Customer ID: VERS96
Customer PO:
Received: 04/17/00 9:51 AM

EMSL Order: 040005817
EMSL Project ID:

Polarized Light Microscopy (PLM) Performed by EPA 600/R-93/116 Method

				Asbestos	Non-Asbestos	
Sample	**Location**	**Appearance**	**Treatment**	**% Type**	**% Fibrous**	**% Non-Fibrous**
90844 *040005817-0005*	Shultz Horticultural Vermiculite	Brown/Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100% Non-fibrous (other)
90845 *040005817-0006*	Country Cottage Horticultural Vermiculite	Brown/Tan Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100% Non-fibrous (other)
90846 *040005817-0007*	ZonoLite- Fines	Tan/Gold Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100% Non-fibrous (other)
90847 *040005817-0008*	ZonoLite - Composite	Gray/Gold Non-Fibrous Heterogeneous	Teased	**None Detected**	<1% Cellulose	100% Non-fibrous (other)

Scott Combs
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: PLM has been known to miss asbestos in a small percentage of samples which contain asbestos. Thus negative PLM results cannot be guaranteed. Samples reported as <1% or none detected should be tested with either SEM or TEM. The above test report relates only to the items tested. This report may only be reproduced in part with written approval by EMSL. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. All "NVLAP" reports with NVLAP logo must contain at least one signature to be valid. Laboratory is not responsible for the accuracy of results when requested to physically separate and analyze layered samples.

4603

Versar

CHAIN OF CUSTODY RECORD

6 TO 10 DAY

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE
4600.008	EPA VERMICULITE	Y / N

SAMPLERS: (Signature) David A. Nelson (Printed) DAVID A. NELSON

PARAMETERS: NO. OF CONTAINERS; PCB SCOPE OF WORK PER P.O. # D25163; TCLP PLM

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PCB SCOPE OF WORK PER P.O. # D25163	TCLP	PLM	REMARKS
90844	4/14/00				VAULT 2 HORTICULTURAL VERMICULITE	1		*		SPRINGFIELD, VA
90845	↓				COUNTRY COTTAGE HORTICULTURAL VERMICULITE	↓		↓		↓
90846					ZOLONITE - FINES					
90847	↓				ZOLONITE - COMPOSITE	↓		↓		

00 APR 17 AM 9:51

SEC 4/20/00

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
David A. Nelson	4/14/00 1740			4/17 9.51	Sharon Carson
(Printed) DAVID A. NELSON	4/14/00 1740	(Printed)	(Printed)		(Printed) Sharon Carson

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
(Printed)		(Printed)		PLEASE SEE PC FAXED CONCERNING ANALYSIS

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

EMSL Analytical, In :.
107 Haddon .ve., Westmont, NJ 08108

Order ID: 040006957

Attn:	David Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID: Customer PO: Received:	VERS96 5/5/00 11:05 AM
Fax: Project:	703-642-6809 4600.008/EPA Vermiculite	EMSL Order: EMSL Project ID:	040006957

Asbestos Analysis of Vermiculite by Transmission Electron Microscopy (TEM)

Client Sample ID	EMSL Sample ID	Asbestos Weight%	Asbestos Type(s)	Ashed / Not Ashed
68180	040006957-0001	0.14%	Actinolite*	Not Ashed
68181	040006957-0002	BQL**	Actinolite*	Not Ashed
68182	040006957-0003	BQL	ND***	Not Ashed
68183	040006957-0004	BQL	Actinolite*	Not Ashed

Key
***Actinolilte/Richterite**
****BQL = Below Quantitation Limit (0.1 weight%)**
*****ND = None Detected**

A.V. Samudra, Ph. D
TEM Analyst

Stephen Siegel. CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **EPA Vermiculite**

Customer ID: VERS96
Customer PO: 07563
Received: 05/05/00 11:05 AM

EMSL Order: 040006957
EMSL Project ID:
Analysis Date: 5/11/2000

Polarized Light Microscopy (PLM) - Point Count Performed by EPA 600/M4-82-020/ELAP 5

Sample	Location	Appearance	Treatment	Non-Asbestos %	Fibrous	Non-Asbestos %	Non-Fibrous	Asbestos %	Type
68180 *040006957-0005*		Brown Fibrous Homogeneous	Teased	5.0%	Cellulose	94.5%	Non-fibrous (other)	0.6%	Tremolite
68181 *040006957-0006*		Brown Fibrous Homogeneous	Teased	8.0%	Cellulose	91.7%	Non-fibrous (other)	0.3%	Tremolite
68182 *040006957-0007*		Brown Fibrous Homogeneous	Teased	10.0%	Cellulose	90.0%	Non-fibrous (other)	<1%	Tremolite
68183 *040006957-0008*		Brown Fibrous Homogeneous	Teased	10.0%	Cellulose	90.0%	Non-fibrous (other)	<1%	Tremolite

Essie Spencer
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: PLM has been known to miss asbestos in a small percentage of samples which contain asbestos. Thus negative PLM results cannot be guaranteed. Samples reported as <1% or none detected should be tested with either SEM or TEM. The above test report relates only to the items tested. This report may only be reproduced in part with written approval by EMSL. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. All "NVLAP" reports with NVLAP logo must contain at least one signature to be valid. Laboratory is not responsible for the accuracy of results when requested to physically separate and analyze layered samples.

CONFIDENTIAL / 600

4594

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE
4601.005	EPA VERMICULITE	Y / N

SAMPLERS (Signature): David A. Nelson (Printed): DAVID A. NELSON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PARAMETERS: PCB SCOPE OF WORK BUD	P.O. #07563	TOX PLM	CTEM	ASBESTOS ANALYSIS	REMARKS
68180	5/4/00				VMR-WRI LAB BACK MATERIAL	1	*				*	FROM EPA
68181	↓				ZONOLITE-REGION 10 PROVIDED	↓						FROM EPA
68182					PURSELL'S STA-GREEN PROFESSIONAL VERMICULITE							SPRINGFIELD, VA
68183	↓				HOFFMAN VERMICULITE	↓						SPRINGFIELD/MINNESOTA

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
David A. Nelson	5/4/00 1859				
(Printed) DAVID A. NELSON	5/4/00 1859	(Printed)	(Printed)		(Printed)
Relinquished by: (Signature)	**Date / Time**	**Received for Laboratory by:** (Signature) Sharon Carson	**Date / Time** 5/5/00 11:05	**Remarks** PLEASE SEE DR. FRASCA CONCERNING ANALYSIS SPECIFICS	
(Printed)		(Printed)			

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EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040007035

Attn:	David Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID: Customer PO: Received:	VERS96 5/8/00 11:20 AM
Fax: Project:	703-642-6809 4600.008/EPA Vermiculite	EMSL Order: EMSL Project ID:	040007035

Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Analytical Electron Microscopy

Client Sample ID	EMSL Sample ID	Asbestos Weight %	Asbestos Type(s)
68184	040007035-1	BQL*	Actinolite
68185	040007035-2	BQL	Anthopyllite
68186	040007035-3	BQL	Actinolite
68187	040007035-4	0.17	Actinolite
68188	040007035-5	BQL	ND**
68189	040007035-6	BQL	ND
68190	040007035-7	BQL	ND
68191	040007035-8	BQL	ND
68192	040007035-9	BQL	Actinolite
68193	040007035-10	BQL	Actinolite

Key
***BQL = Below Quantitation Limit (0.1 weight%)**
****ND = None Detected**

Note: All samples were not ashed prior to analysis

A.V. Samudra, Ph.D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.

107 Haddon Ave., Westmont, NJ 08108

Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151

Fax: 703-642-6809 Phone: 703-642-6889

Project: **4601.005/EPA Vermiculite**

Customer ID: VERS96
Customer PO: 07563
Received: 05/08/00 11:20 AM

EMSL Order: 040007035
EMSL Project ID:
Analysis Date: 5/16/2000

Polarized Light Microscopy (PLM) - Point Count Performed by EPA 600/M4-82-020/ELAP 5

Sample	Location	Appearance	Treatment	Non-Asbestos % Fibrous	Non-Asbestos % Non-Fibrous	Asbestos % Type
68184 *040007035-0001*	ACE HORTICULTURA	Brown Fibrous Homogeneous	Teased	3.0% Min. Wool 3.0% Wollastonite	94.0% Non-fibrous (other)	None Detected
68185 *040007035-0002*	HOFFMAN HORTICULTURA	Brown Fibrous Homogeneous	Teased	3.0% Cellulose 2.0% Wollastonite	95.0% Non-fibrous (other)	<1% Tremolite
68186 *040007035-0003*	ACE HORTICULTURA	Brown Fibrous Homogeneous	Teased	3.0% Cellulose 2.0% Wollastonite	95.0% Non-fibrous (other)	None Detected
68187 *040007035-0004*	EARTHGRO'S BEST	Brown Fibrous Homogeneous	Teased	5.0% Cellulose 3.0% Wollastonite	92.0% Non-fibrous (other)	<1% Tremolite
68188 *040007035-0005*	SCHULTZ HORTICULTURA	Brown Fibrous Homogeneous	Teased	4.0% Cellulose 3.0% Wollastonite	93.0% Non-fibrous (other)	None Detected
68189 *040007035-0006*	SCHULTZ HORTICULTURA	Brown Fibrous Homogeneous	Teased	5.0% Cellulose 5.0% Wollastonite	90.0% Non-fibrous (other)	None Detected
68190 *040007035-0007*	BLACK GOLD VERMICULITE	Brown Fibrous Homogeneous	Teased	3.0% Cellulose 2.0% Wollastonite	95.0% Non-fibrous (other)	<1% Chrysotile <1% Tremolite
68191 *040007035-0008*	WHITNEY FARMS	Beige Fibrous Homogeneous	Teased	3.0% Cellulose 2.0% Wollastonite	95.0% Non-fibrous (other)	None Detected
68192 *040007035-0009*	SCOTTS VERMICULITE	Brown Fibrous Homogeneous	Teased	10.0% Cellulose 5.0% Wollastonite	85.0% Non-fibrous (other)	None Detected
68193 *040007035-0010*	HOFFMAN AFRICAN	Brown Fibrous Homogeneous	Teased	10.0% Cellulose 10.0% Wollastonite	80.0% Non-fibrous (other)	None Detected

Essie Spencer
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: PLM has been known to miss asbestos in a small percentage of samples which contain asbestos. Thus negative PLM results cannot be guaranteed. Samples reported as <1% or none detected should be tested with either SEM or TEM. The above test report relates only to the items tested. This report may only be reproduced in part with written approval by EMSL. The above test must not be used by the client to claim product endorsement by NVLAP nor any agency of the United States Government. All "NVLAP" reports with NVLAP logo must contain at least one signature to be valid. Laboratory is not responsible for the accuracy of results when requested to physically separate and analyze layered samples.

4609

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE Y / N
4601.005	EPA VERMICULITE		

SAMPLERS: (Signature) David P. Nelson (Printed) DAVID P. NELSON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	ICP SCOPE	CF WORK AUTH P.O. # 07563	TOC PLM & TEM ANALYSIS	REMARKS
68184	5/5/00				ACE HORTICULTURAL GRADE VERMICULITE	1				MIAMI, FLA
68185					HOFFMAN HORTICULTURAL VERMICULITE					BLUE EARTH, MN
68186					ACE HORTICULTURAL GRADE VERMICULITE			*		MINNEAPOLIS, MN
68187					FARMERS BEST VERMICULITE					RICHFIELD, MN
68188					SCHULTZ HORTICULTURAL VERMICULITE					BURKE, VA
68189					SCHULTZ HORTICULTURAL VERMICULITE					MIAMI, FLORIDA
68190					BLACK GOLD VERMICULITE					SACRAMENTO, CA
68191					WHITNEY FARMS AFRICAN VIOLET MIX					TEMPE, AZ
68192					SCOTTS VERMICULITE					SAN ANTONIO, TX
68193					HOFFMAN AFRICAN VIOLET SOIL MIX					BRISTOL, PA

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
David P. Nelson	5/5/00 1550				5/16/00
(Printed) DAVID A. NELSON	5/5/00 1530	(Printed) Stephen Sim	(Printed)		(Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks PLEASE SEE DR. FRASCA CONCERNING ANALYSIS SPECIFICS	
(Printed)		(Printed)			

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink)

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Attn:	David Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID: Customer PO: Received:	VERS96 5/4/00 12:58 PM
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Asbestos Analysis of Bulk Materials via EMSL SOP 2000 Method using Polarized Light (PLM) and Transmission Electron Microscopy (TEM)

Client Sample ID	EMSL Sample ID	PLM Results EPA Point Count	TEM Results	Asbestos Type(s)
90813	040006832-0001	ND*	BDL**	**ND**
90831	040006832-0002	ND	BDL	**ND**
90832	040006832-0004	ND	BDL	**Actinolite/Tremolite**
90833	040006832-0003	ND	BDL	**ND**
90844	040006832-0005	ND	BDL	**ND**

Key
***ND = None Detected**
****BDL = Below Detection Limit (0.1 weight%)**

Essie Spencer
PLM Analyst

Stephen Siegel. CIH- Lab Manager
Or other approved signatory

A. V. Samudra, Ph. D
TEM Analyst

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID: Customer PO: Received: Report Date:	VERS96 5/4/00 12:58 PM 5/17/00
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Releasable Asbestos in Respirable Dust

Client/Lab Sample ID	Respirable Dust Conc (g/g smpl)	Total Asbestos Analytical Sensitivity (s/g dust)	Total Asbestos Concentration (s/g dust)	Total Asbestos 95% UCL (s/g dust)	Long Asbestos Analytical Sensitivity (s/g dust)	Long Asbestos Conc (s/g dust)	Long Asbestos 95% UCL (s/g dust)	Dust Generation Rate (at 60 rpm) (g/min)
90813/ 040006832-1	2.516E-06	1.47E+08	<1.47E+08	<2.88E+08	1.47E+08	<1.47E+08	<2.88E+08	8.60E-05
90831/ 040006832-2	9.542E-07	2.52E+08	<2.52E+08	<4.95E+08	2.52E+08	<2.52E+08	<4.95E+08	5.00E-05
90832/ 040006832-3	6.629E-07	5.74E+08	<5.74E+08	<1.12E+09	5.74E+08	<5.74E+08	<1.12E+09	2.20E-05
90833/ 040006832-4	1.311E-07	3.16E+09	<3.16E+09	<6.19E+09	3.16E+09	<3.16E+09	<6.19E+09	4.00E-06
90844/ 040006832-5	2.926E-06	7.25E+07	2.18E+08	4.27E+08	7.25E+07	1.45E+08	2.84E+08	1.74E-04

A.V. Samudra, Ph.D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID: Customer PO: Received: Report Date:	VERS96 5/4/00 12:58 PM 5/17/00
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Releasable Asbestos in Laboratory Samples

Client/Lab Sample ID	Respirable Dust Conc (g/g smpl)	Total Asbestos Analytical Sensitivity (s/g smpl)	Total Asbestos Concentration (s/g smpl)	Total Asbestos 95% UCL (s/g smpl)	Long Asbestos Analytical Sensitivity (s/g smpl)	Long Asbestos Conc (s/g smpl)	Long Asbestos 95% UCL (s/g smpl)	Comments
90813/ 040006832-1	2.516E-06	369.36	<369.36	<723.95	369.36	<369.36	<723.95	
90831/ 040006832-2	9.542E-07	240.90	<240.90	<472.17	240.90	<240.90	<472.17	
90832/ 040006832-3	6.629E-07	380.35	<380.35	<745.49	380.35	<380.35	<745.49	
90833/ 040006832-4	1.311E-07	413.63	<413.63	<810.72	413.63	<413.63	<810.72	
90844/ 040006832-5	2.926E-06	212.25	636.76	416.02	212.25	212.25	416.02	

A.V. Samudra, Ph.D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson	Customer ID:	VERS96
	Versar Inc.	Customer PO:	
	6850 Versar Center	Received:	5/4/00 12:58 PM
	PO Box 1549	Report Date:	5/17/00
	Springfield, VA 22151		
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Client Sample# 90813
EMSL Sample# 40006832-001

Chrysotile Asbestos Analysis Results	Low Magnification	High Magnification
No. of Total Chrysotile Asbestos Structures	N/A	0
No. of Long (>5 µm) Chrysotile Asbestos Structures	N/A	0
No. of Total Chrysotile Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Chrysotile Asbestos Fibers/Bundles	N/A	0
Amphibole Asbestos Analysis Results		
No. of Total Amphibole Asbestos Structures	N/A	0
No. of Long (>5 µm) Amphibole Asbestos Structures	N/A	0
No. of Total Amphibole Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Amphibole Asbestos Fibers/Bundles	N/A	0
Amphibole Mineral Type-	N/A	N/A

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN SAMPLE	Conc.	95% UCL
Total Chrysotile Structures per g Sample	<369.36	<723.95
Total Amphibole Structures per g Sample	<369.36	<723.95
Total Asbestos Structures per g Sample	<369.36	<723.95
Long Chrysotile Structures per g Sample	<369.36	<723.95
Long Amphibole Structures per g Sample	<369.36	<723.95
Long Asbestos Structures per g Sample	<369.36	<723.95
Estimated Analytical Sensitivity: (structures/g)	<369.36	<723.95

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN RESPIRABLE DUST OF SAMPLE	Conc.	95% UCL
Total Chrysotile Structures per g Dust	<146,778,498	<287,685,856
Total Amphibole Structures per g Dust	<146,778,498	<287,685,856
Total Asbestos Structures per g Dust	<146,778,498	<287,685,856
Long Chrysotile Structures per g Dust	<146,778,498	<287,685,856
Long Amphibole Structures per g Dust	<146,778,498	<287,685,856
Long Asbestos Structures per g Dust	<146,778,498	<287,685,856
Estimated Analytical Sensitivity: (structures/g dust)	<146,778,498	<287,685,856

A.V. Samudra, Ph.D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson	Customer ID:	VERS96
	Versar Inc.	Customer PO:	
	6850 Versar Center	Received:	5/4/00 12:58 PM
	PO Box 1549	Report Date:	5/17/00
	Springfield, VA 22151		
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Date Analysis Started	5/9/00
Date Analysis Completed	5/10/00
Lab Sample #	040006832-0001
Field Sample ID Number	90813
Field Prepartation Technique	N/A
Additional Lab Preparation Procedures	
Sample Drying	Yes
Sample Splitting	N/A
Other	
TEM Analysis	
Effective Area of Analytical Filter (sq mm)	385
Magnification	19,000X
Grid Opening Area (sq mm)	0.0061
Number of G.O. Scanned	10
Asbestos Structure Size and Type Categories of Interest	>0.5µ Length <0.5µ Diameter >5:1 Aspect Ratio Amphiboles/Chrysotile
Minimum Acceptable Structure ID Category	>0.5µ Length <0.5µ Diameter >5:1 Aspect Ratio
Dust Generator	
Mass of Sample Tumbled (g)	17.0874
Air Flow Rate Through ME opening of Dust Generator (ml/min)	1500
Air Flow Rate Through IST opening of Dust Generator (ml/min)	1300
Air Flow Rate Scrubber (ml/min)	N/A
Estimated Total Air Flow Rate Through Elutriator (ml/min)	1300
Total Mass of Dust Collected on Dust Filters (g)	0.00043
Time of Dust Collection (24 hr clock) at 60 rpm	30 sec
Start/Stop	N/A
Estimated first-order rate constants for dust generation (min^{-1}) at 60 rpm	2
Samples from the Isokinetic Sampling Tube (IST) Opening of the Dust Generator	60 rpm run
Time of Collection (24 hr clock)	30 sec
Start/Stop	N/A
Estimated Mass of Dust Collected on Filter (g)	0.00043

A.V. Samudra, Ph. D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson	Customer ID:	VERS96
	Versar Inc.	Customer PO:	
	6850 Versar Center	Received:	5/4/00 12:58 PM
	PO Box 1549	Report Date:	5/17/00
	Springfield, VA 22151		
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Date Analysis Started	5/9/00
Date Analysis Completed	5/10/00
Lab Sample #	040006832-0002
Field Sample ID Number	90831
Field Prepartation Technique	N/A
Additional Lab Preparation Procedures	
Sample Drying	Yes
Sample Splitting	N/A
Other	
TEM Analysis	
Effective Area of Analytical Filter (sq mm)	385
Magnification	19,000X
Grid Opening Area (sq mm)	0.0061
Number of G.O. Scanned	10
Asbestos Structure Size and Type Categories of Interest	>0.5µ Length <0.5µ Diameter >5:1 Aspect Ratio Amphiboles/Chrysotile
Minimum Acceptable Structure ID Category	>0.5µ Length <0.5µ Diameter >5:1 Aspect Ratio
Dust Generator	
Mass of Sample Tumbled (g)	26.1993
Air Flow Rate Through ME opening of Dust Generator (ml/min)	1500
Air Flow Rate Through IST opening of Dust Generator (ml/min)	1300
Air Flow Rate Scrubber (ml/min)	N/A
Estimated Total Air Flow Rate Through Elutriator (ml/min)	1300
Total Mass of Dust Collected on Dust Filters (g)	0.00025
Time of Dust Collection (24 hr clock) at 60 rpm	30 sec
Start/Stop	N/A
Estimated first-order rate constants for dust generation (min^{-1}) at 60 rpm	2
Samples from the Isokinetic Sampling Tube (IST) Opening of the Dust Generator	60 rpm run
Time of Collection (24 hr clock)	30 sec
Start/Stop	N/A
Estimated Mass of Dust Collected on Filter (g)	0.00025

A.V. Samudra, Ph. D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson	Customer ID:	VERS96
	Versar Inc.	Customer PO:	
	6850 Versar Center	Received:	5/4/00 12:58 PM
	PO Box 1549	Report Date:	5/17/00
	Springfield, VA 22151		
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Client Sample# 90831
EMSL Sample# 040006832-002

Chrysotile Asbestos Analysis Results	Low Magnification	High Magnification
No. of Total Chrysotile Asbestos Structures	N/A	0
No. of Long (>5 µm) Chrysotile Asbestos Structures	N/A	0
No. of Total Chrysotile Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Chrysotile Asbestos Fibers/Bundles	N/A	0
Amphibole Asbestos Analysis Results		
No. of Total Amphibole Asbestos Structures	N/A	0
No. of Long (>5 µm) Amphibole Asbestos Structures	N/A	0
No. of Total Amphibole Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Amphibole Asbestos Fibers/Bundles	N/A	0
Amphibole Mineral Type-	N/A	N/A

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN SAMPLE	Conc.	95% UCL
Total Chrysotile Structures per g Sample	<240.90	<472.17
Total Amphibole Structures per g Sample	<240.90	<472.17
Total Asbestos Structures per g Sample	<240.90	<472.17
Long Chrysotile Structures per g Sample	<240.90	<472.17
Long Amphibole Structures per g Sample	<240.90	<472.17
Long Asbestos Structures per g Sample	<240.90	<472.17
Estimated Analytical Sensitivity: (structures/g)	<240.90	<472.17

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN RESPIRABLE DUST OF SAMPLE	Conc.	95% UCL
Total Chrysotile Structures per g Dust	<252,459,016	<494,819,672
Total Amphibole Structures per g Dust	<252,459,016	<494,819,672
Total Asbestos Structures per g Dust	<252,459,016	<494,819,672
Long Chrysotile Structures per g Dust	<252,459,016	<494,819,672
Long Amphibole Structures per g Dust	<252,459,016	<494,819,672
Long Asbestos Structures per g Dust	<252,459,016	<494,819,672
Estimated Analytical Sensitivity: (structures/g dust)	<252,459,016	<494,819,672

A.V. Samudra, Ph.D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson	Customer ID:	VERS96
	Versar Inc.	Customer PO:	
	6850 Versar Center	Received:	5/4/00 12:58 PM
	PO Box 1549	Report Date:	5/17/00
	Springfield, VA 22151		
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Date Analysis Started	5/9/00
Date Analysis Completed	5/10/00
Lab Sample #	040006832-0003
Field Sample ID Number	90832
Field Prepartation Technique	N/A
Additional Lab Preparation Procedures	
Sample Drying	Yes
Sample Splitting	N/A
Other	
TEM Analysis	
Effective Area of Analytical Filter (sq mm)	385
Magnification	19,000X
Grid Opening Area (sq mm)	0.0061
Number of G.O. Scanned	10
Asbestos Structure Size and Type Categories of Interest	>0.5µ Length <0.5µ Diameter >5:1 Aspect Ratio Amphiboles/Chrysotile
Minimum Acceptable Structure ID Category	>0.5µ Length <0.5µ Diameter >5:1 Aspect Ratio
Dust Generator	
Mass of Sample Tumbled (g)	16.5938
Air Flow Rate Through ME opening of Dust Generator (ml/min)	1500
Air Flow Rate Through IST opening of Dust Generator (ml/min)	1300
Air Flow Rate Scrubber (ml/min)	N/A
Estimated Total Air Flow Rate Through Elutriator (ml/min)	1300
Total Mass of Dust Collected on Dust Filters (g)	0.00011
Time of Dust Collection (24 hr clock) at 60 rpm	30 sec
Start/Stop	N/A
Estimated first-order rate constants for dust generation (min^{-1}) at 60 rpm	2
Samples from the Isokinetic Sampling Tube (IST) Opening of the Dust Generator	60 rpm run
Time of Collection (24 hr clock)	30 sec
Start/Stop	N/A
Estimated Mass of Dust Collected on Filter (g)	0.00011

A.V. Samudra, Ph. D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson	Customer ID:	VERS96
	Versar Inc.	Customer PO:	
	6850 Versar Center	Received:	5/4/00 12:58 PM
	PO Box 1549	Report Date:	5/17/00
	Springfield, VA 22151		
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Client Sample# 90832
EMSL Sample# 040006832-003

Chrysotile Asbestos Analysis Results	Low Magnification	High Magnification
No. of Total Chrysotile Asbestos Structures	N/A	0
No. of Long (>5 µm) Chrysotile Asbestos Structures	N/A	0
No. of Total Chrysotile Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Chrysotile Asbestos Fibers/Bundles	N/A	0
Amphibole Asbestos Analysis Results		
No. of Total Amphibole Asbestos Structures	N/A	0
No. of Long (>5 µm) Amphibole Asbestos Structures	N/A	0
No. of Total Amphibole Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Amphibole Asbestos Fibers/Bundles	N/A	0
Amphibole Mineral Type-	N/A	N/A

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN SAMPLE	Conc.	95% UCL
Total Chrysotile Structures per g Sample	<380.35	<745.49
Total Amphibole Structures per g Sample	<380.35	<745.49
Total Asbestos Structures per g Sample	<380.35	<745.49
Long Chrysotile Structures per g Sample	<380.35	<745.49
Long Amphibole Structures per g Sample	<380.35	<745.49
Long Asbestos Structures per g Sample	<380.35	<745.49
Estimated Analytical Sensitivity: (structures/g)	<380.35	<745.49

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN RESPIRABLE DUST OF SAMPLE	Conc.	95% UCL
Total Chrysotile Structures per g Dust	<252,459,016	<494,819,672
Total Amphibole Structures per g Dust	<252,459,016	<494,819,672
Total Asbestos Structures per g Dust	<252,459,016	<494,819,672
Long Chrysotile Structures per g Dust	<252,459,016	<494,819,672
Long Amphibole Structures per g Dust	<252,459,016	<494,819,672
Long Asbestos Structures per g Dust	<252,459,016	<494,819,672
Estimated Analytical Sensitivity: (structures/g dust)	<252,459,016	<494,819,672

A.V. Samudra, Ph.D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson	Customer ID:	VERS96
	Versar Inc.	Customer PO:	
	6850 Versar Center	Received:	5/4/00 12:58 PM
	PO Box 1549	Report Date:	5/17/00
	Springfield, VA 22151		
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Date Analysis Started	5/9/00
Date Analysis Completed	5/10/00
Lab Sample #	040006832-0004
Field Sample ID Number	90833
Field Prepartation Technique	N/A
Additional Lab Preparation Procedures	
Sample Drying	Yes
Sample Splitting	N/A
Other	
TEM Analysis	
Effective Area of Analytical Filter (sq mm)	385
Magnification	19,000X
Grid Opening Area (sq mm)	0.0061
Number of G.O. Scanned	10
Asbestos Structure Size and Type Categories of Interest	>0.5µ Length <0.5µ Diameter >5:1 Aspect Ratio Amphiboles/Chrysotile
Minimum Acceptable Structure ID Category	>0.5µ Length <0.5µ Diameter >5:1 Aspect Ratio
Dust Generator	
Mass of Sample Tumbled (g)	15.2587
Air Flow Rate Through ME opening of Dust Generator (ml/min)	1500
Air Flow Rate Through IST opening of Dust Generator (ml/min)	1300
Air Flow Rate Scrubber (ml/min)	N/A
Estimated Total Air Flow Rate Through Elutriator (ml/min)	1300
Total Mass of Dust Collected on Dust Filters (g)	0.00002
Time of Dust Collection (24 hr clock) at 60 rpm	30 sec
Start/Stop	N/A
Estimated first-order rate constants for dust generation (min^{-1}) at 60 rpm	2
Samples from the Isokinetic Sampling Tube (IST) Opening of the Dust Generator	60 rpm run
Time of Collection (24 hr clock)	30 sec
Start/Stop	N/A
Estimated Mass of Dust Collected on Filter (g)	0.00002

A.V. Samudra, Ph. D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID: Customer PO: Received: Report Date:	VERS96 5/4/00 12:58 PM 5/17/00
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Client Sample# 90833
EMSL Sample# 040006832-004

Chrysotile Asbestos Analysis Results	Low Magnification	High Magnification
No. of Total Chrysotile Asbestos Structures	N/A	0
No. of Long (>5 µm) Chrysotile Asbestos Structures	N/A	0
No. of Total Chrysotile Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Chrysotile Asbestos Fibers/Bundles	N/A	0
Amphibole Asbestos Analysis Results		
No. of Total Amphibole Asbestos Structures	N/A	0
No. of Long (>5 µm) Amphibole Asbestos Structures	N/A	0
No. of Total Amphibole Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Amphibole Asbestos Fibers/Bundles	N/A	0
Amphibole Mineral Type-	N/A	N/A

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN SAMPLE	Conc.	95% UCL
Total Chrysotile Structures per g Sample	<413.63	<810.72
Total Amphibole Structures per g Sample	<413.63	<810.72
Total Asbestos Structures per g Sample	<413.63	<810.72
Long Chrysotile Structures per g Sample	<413.63	<810.72
Long Amphibole Structures per g Sample	<413.63	<810.72
Long Asbestos Structures per g Sample	<413.63	<810.72
Estimated Analytical Sensitivity: (structures/g)	<413.63	<810.72

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN RESPIRABLE DUST OF SAMPLE	Conc.	95% UCL
Total Chrysotile Structures per g Dust	<3,155,737,705	<6,185,245,902
Total Amphibole Structures per g Dust	<3,155,737,705	<6,185,245,902
Total Asbestos Structures per g Dust	<3,155,737,705	<6,185,245,902
Long Chrysotile Structures per g Dust	<3,155,737,705	<6,185,245,902
Long Amphibole Structures per g Dust	<3,155,737,705	<6,185,245,902
Long Asbestos Structures per g Dust	<3,155,737,705	<6,185,245,902
Estimated Analytical Sensitivity: (structures/g dust)	<3,155,737,705	<6,185,245,902

A.V. Samudra, Ph.D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson	Customer ID:	VERS96
	Versar Inc.	Customer PO:	
	6850 Versar Center	Received:	5/4/00 12:58 PM
	PO Box 1549	Report Date:	5/17/00
	Springfield, VA 22151		
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Date Analysis Started	5/9/00
Date Analysis Completed	5/10/00
Lab Sample #	040006832-0005
Field Sample ID Number	90844
Field Prepartation Technique	N/A
Additional Lab Preparation Procedures	
Sample Drying	Yes
Sample Splitting	N/A
Other	
TEM Analysis	
Effective Area of Analytical Filter (sq mm)	385
Magnification	19,000X
Grid Opening Area (sq mm)	0.0061
Number of G.O. Scanned	10
Asbestos Structure Size and Type Categories of Interest	>0.5µ Length <0.5µ Diameter >5:1 Aspect Ratio Amphiboles/Chrysotile
Minimum Acceptable Structure ID Category	>0.5µ Length <0.5µ Diameter >5:1 Aspect Ratio
Dust Generator	
Mass of Sample Tumble (g)	29.7354
Air Flow Rate Through ME opening of Dust Generator (ml/min)	1500
Air Flow Rate Through IST opening of Dust Generator (ml/min)	1300
Air Flow Rate Scrubber (ml/min)	N/A
Estimated Total Air Flow Rate Through Elutriator (ml/min)	1300
Total Mass of Dust Collected on Dust Filters (g)	0.00087
Time of Dust Collection (24 hr clock) at 60 rpm	30 sec
Start/Stop	N/A
Estimated first-order rate constants for dust generation (min^{-1}) at 60 rpm	2
Samples from the Isokinetic Sampling Tube (IST) Opening of the Dust Generator	60 rpm run
Time of Collection (24 hr clock)	30 sec
Start/Stop	N/A
Estimated Mass of Dust Collected on Filter (g)	0.00087

A.V. Samudra, Ph. D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040006832

Asbestos Analysis via EPA Superfund Method for the Determination of Releasable Asbestos Fibers in Soils and Bulk Materials- EPA540-R-97-028

Attn:	David Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID: Customer PO: Received: Report Date:	VERS96 5/4/00 12:58 PM 5/17/00
Fax:	703-642-6809	EMSL Order:	040006832
Project:	4600.008/EPA Vermiculite	EMSL Project ID:	

Client Sample# 90844
EMSL Sample# 040006832-005

Chrysotile Asbestos Analysis Results	Low Magnification	High Magnification
No. of Total Chrysotile Asbestos Structures	N/A	0
No. of Long (>5 µm) Chrysotile Asbestos Structures	N/A	0
No. of Total Chrysotile Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Chrysotile Asbestos Fibers/Bundles	N/A	0
Amphibole Asbestos Analysis Results		
No. of Total Amphibole Asbestos Structures	N/A	3
No. of Long (>5 µm) Amphibole Asbestos Structures	N/A	2
No. of Total Amphibole Asbestos Fibers/Bundles	N/A	0
No. of Long (>5 µm) Amphibole Asbestos Fibers/Bundles	N/A	0
Amphibole Mineral Type-	N/A	Actinolite/Richterite

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN SAMPLE	Conc.	95% UCL
Total Chrysotile Structures per g Sample	<212.25	<416.02
Total Amphibole Structures per g Sample	636.76	1248.06
Total Asbestos Structures per g Sample	636.76	1248.06
Long Chrysotile Structures per g Sample	<212.25	<416.02
Long Amphibole Structures per g Sample	212.25	416.02
Long Asbestos Structures per g Sample	212.25	416.02
Estimated Analytical Sensitivity: (structures/g)	<212.25	<416.02

ESTIMATED CONCENTRATIONS OF RELEASABLE ASBESTOS IN RESPIRABLE DUST OF SAMPLE	Conc.	95% UCL
Total Chrysotile Structures per g Dust	<72,545,694	<142,189,561
Total Amphibole Structures per g Dust	217,637,083	426,568,683
Total Asbestos Structures per g Dust	217,637,083	426,568,683
Long Chrysotile Structures per g Dust	<72,545,694	<142,189,561
Long Amphibole Structures per g Dust	145,091,389	284,379,122
Long Asbestos Structures per g Dust	145,091,389	284,379,122
Estimated Analytical Sensitivity: (structures/g dust)	<72,545,694	<142,189,561

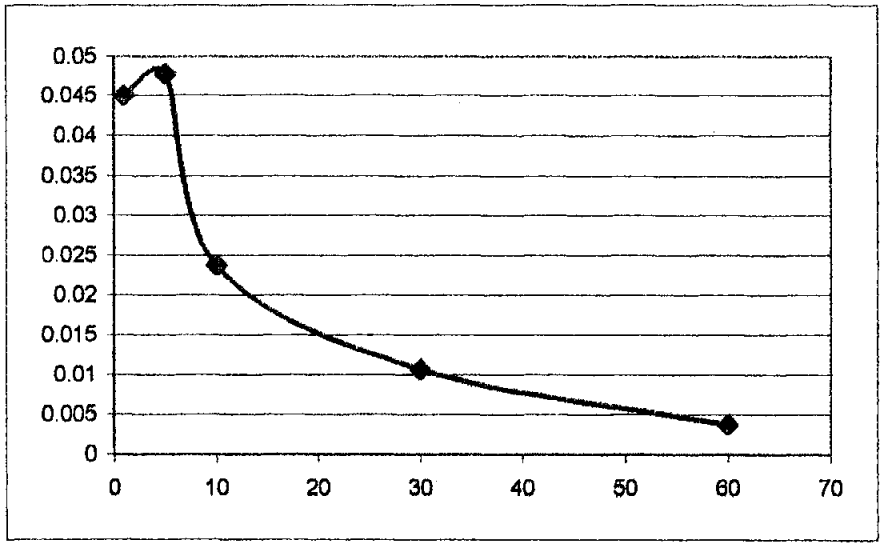
A.V. Samudra, Ph.D.
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

Sample	90813		
ME Port	Sample wt	Tare	Final
1	0.045	19.581	19.626
5	0.239	19.178	19.417
10	0.237	18.449	18.686
30	0.319	18.379	18.698
60	0.221	18.379	18.6
IST Port	0.043	18.598	18.641

Release / Minute

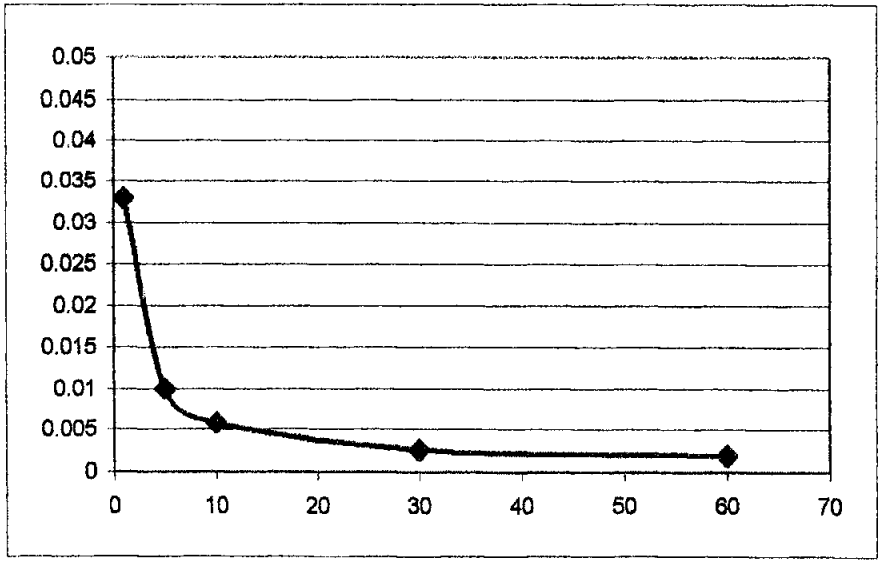
1	0.045
5	0.0478
10	0.0237
30	0.010633333
60	0.003683333



Sample	90831		
ME Port	Sample wt	Tare	Final
1	0.033	19.029	19.062
5	0.05	20.514	20.564
10	0.058	17.84	17.898
30	0.075	18.782	18.857
60	0.111	18.749	18.86
IST Port	0.025	18.785	18.81

Release / Minute

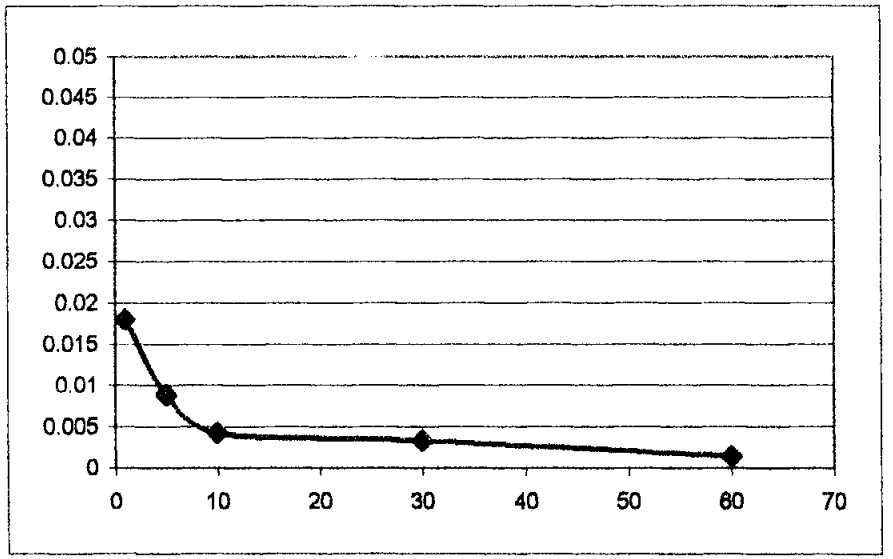
1	0.033
5	0.01
10	0.0058
30	0.0025
60	0.00185



Sample	90832		
ME Port	Sample wt	Tare	Final
1	0.018	19.683	19.701
5	0.044	19.448	19.492
10	0.043	19.432	19.475
30	0.101	19.901	20.002
60	0.088	20.375	20.463
IST Port	0.011	19.152	19.163

Release / Minute

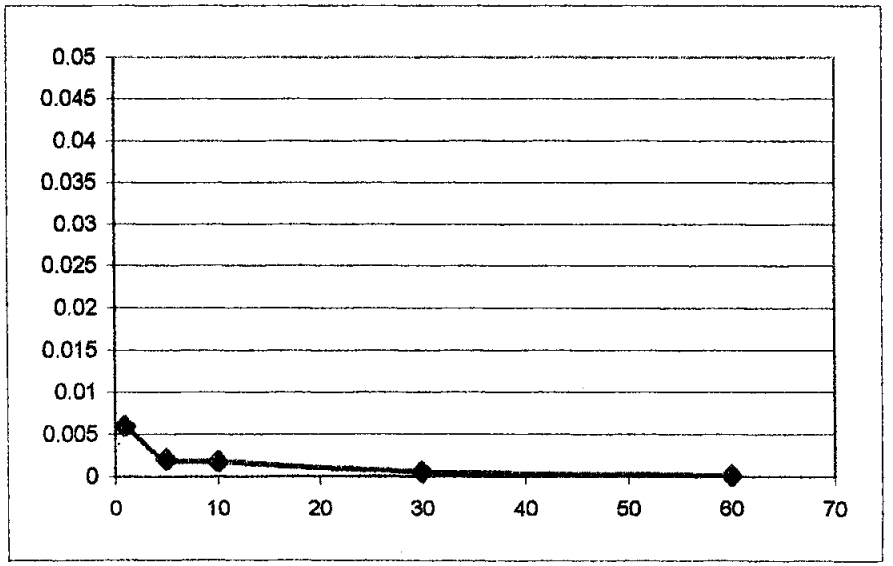
1	0.018
5	0.0088
10	0.0043
30	0.003366667
60	0.001466667



Sample	90833		
ME Port	Sample wt	Tare	Final
1	0.006	18.305	18.311
5	0.01	19.439	19.449
10	0.018	19.444	19.462
30	0.016	20.982	20.998
60	0.01	19.583	19.593
IST Port	0.002	18.989	18.991

Release / Minute

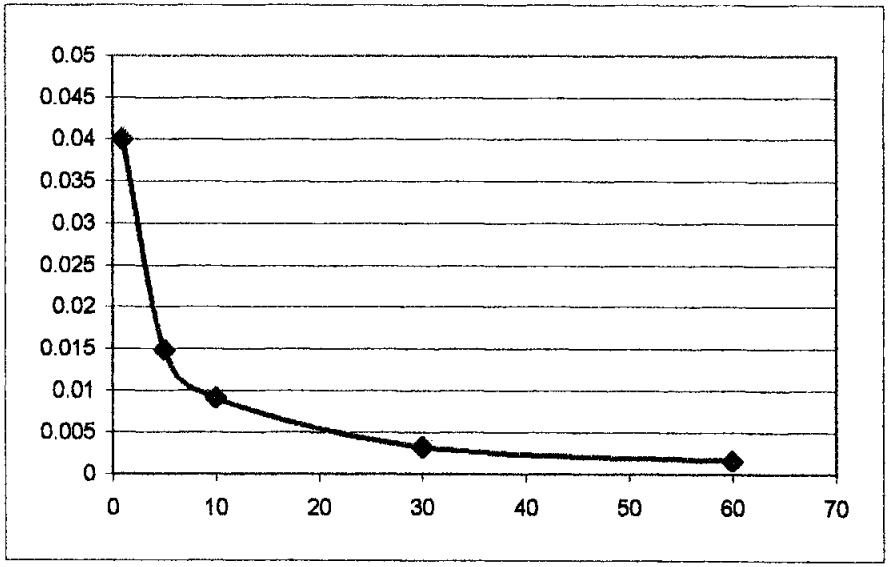
1	0.006
5	0.002
10	0.0018
30	0.000533333
60	0.000166667



Sample	90844		
ME Port	Sample wt	Tare	Final
1	0.04	19.254	19.294
5	0.074	19.582	19.656
10	0.091	19.511	19.602
30	0.097	19.886	19.983
60	0.098	20.404	20.502
IST Port	0.087	20.502	20.589

Release / Minute

1	0.04
5	0.0148
10	0.0091
30	0.003233333
60	0.001633333



EMSL Analytical, Inc.
107 H..ldon Ave., Westmont, NJ 08108

EMSL

Order ID: 040008582

Attn:	Linda Phillips/David Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID: Customer PO: Received:	VERS96 06/01/00 3:00 PM
Fax: Project:	703-642-6809 4600.008/EPA Vermiculite	EMSL Order: EMSL Project ID:	040008582

Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Analytical Electron Microscopy

Client Sample ID	EMSL Sample ID	Asbestos Weight%	Asbestos Type(s)	Ashed / Not Ashed
90831	040008582-1	BQL*	ND**	Not Ashed
90844	040008582-2	BQL	ND	Not Ashed
90847	040008582-3	BQL	ND	Not Ashed

This analysis is on fine portion of sample after sieving with #10 and #35 sieves.

Key
***BQL = Below Quantitation Limit (0.1 weight%)**
****ND = None Detected**

A.V. Samudra, Ph. D
TEM Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040008582

Attn: Linda Phillips/David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809
Project: 4600.008/EPA Vermiculite

Customer ID: VERS96
Customer PO:
Received: 06/01/00 3:00 PM

EMSL Order: 040008582
EMSL Project ID:

EPA Protocol for Screening Soil and Sediment Samples For Asbestos Content Used by USEPA, Region 1 Laboratory (Rev May 24, 1994) Modified by EMSL (Sept 1999)

Client Sample ID	EMSL Sample ID	Location	% Asbestos
90831	040008582-1		None Detected
90844	040008582-2		None Detected
90847	040008582-3		None Detected

Samples were sieved to coarse, medium, and fine portions using #10 and #35 sieves.

David Poitras
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

4605

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
41001.005	EPA VERMICULITE

SAMPLER(S) (Signature): David Nelson

(Printed): David A. Nelson

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	See Remarks	PARAMETERS	REMARKS
90831					SEE REMARKS	1	✓		
90844					SECTION	↓	↓		
90847						↓	↓		

INDUSTRIAL HYGIENE SAMPLE: Y / N

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
David Nelson	6/2/00 1200				
(Printed) David A. Nelson	6/2/00 1200	(Printed)	(Printed)		(Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks: PROVIDE ANALYSES BY EMSL/EPA QUANTITATIVE SOIL METHOD WITH TEM CONVENTIONAL ON FINE PORTION	
(Printed)		(Printed)			

JUN-02-00 13:39 FROM:VERSAR ENV. DIV. ID:7036428809 PAGE 4/4

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

Order ID: 040009370

Attn:	Linda Phillips/David Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID: Customer PO: Received:	VERS96 06/14/00 9:54 AM
Fax:	703-642-6809	EMSL Order:	040009370
Project:	4600.005/EPA Vermiculite	EMSL Project ID:	

Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Analytical Electron Microscopy

Client Sample ID	EMSL Sample ID	Asbestos Weight%	Asbestos Type(s)	Ashed / Not Ashed
68194	040009370-1	BQL*	Tremolite/Actinolite	Not Ashed

- This result is for TEM of fine portion of sample.
- Asbestos amount in original sample based on this value, and ND in coarse and medium portions (by PLM) is **<0.02% Tremolite/Actinolite.**
- The samples was sieved to coarse, medium, and fine portions using #10 and #35 sieves.

Key
***BQL = Below Quantitation Limit (0.1 weight%)**

A.V. Samudra, Ph. D
TEM Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108

EMSL

Order ID: 040009370

Attn:	Linda Phillips/David Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID: Customer PO: Received:	VERS96 06/14/00 9:54 AM
Fax:	703-642-6809	EMSL Order:	040009370
Project:	4600.005/EPA Vermiculite	EMSL Project ID:	

EPA Protocol for Screening Soil and Sediment Samples For Asbestos Content Used by USEPA, Region 1 Laboratory (Rev May 24, 1994) Modified by EMSL (Sept 1999)

Client Sample ID	EMSL Sample ID	Location	% Asbestos
68194	040009370-1		< 0.19% Tremolite

- Samples were sieved to coarse, medium, and fine portions using #10 and #35 sieves.
- Final Asbestos result reported is based on ND in coarse and medium portions, <1% Tremolite in fine portion by PLM.

Scott Combs
Analyst

Stephen Siegel, CIH- Lab Manager
Or other approved signatory

4596

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	INDUSTRIAL HYGIENE SAMPLE
4601.005	EPA VERMICULITE	Y / N

SAMPLERS: (Signature) David A. Nelson (Printed) DAVID A. NELSON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TCLP	PARAMETERS	REMARKS
68194	6/13/00				ZONOLITE CHEMICAL PACKAGING MATERIAL	1	V		FINES FROM BOTTOM OF BAG

06 JUN 11 PM 5:54

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
David A. Nelson	6/13/00 1500				
(Printed) DAVID A. NELSON	6/13/00 1500	(Printed)	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
		Sharon Carson		PLEASE SEE STEVE SIEGAL FOR SPECIFIC ANALYSIS PREP - TO BE SIEVED THROUGH #10 & 35 SCREENS
(Printed)		(Printed) Sharon Carson		

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink)

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: Linda Phillips/Dave Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **4601.005/EPA WIMSATT**

Customer ID: VERS96
Customer PO:
Received: 05/26/00 12:17 PM

EMSL Order: 040008279
EMSL Project ID:
Analysis Date: 5/30/2000

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selected Area Elec Diffraction (SAED), and Energy Dispersive X-Ray Microanalysis (EDX) - Performed by EPA Level II Method.

Sample	Volume (liters)	Asbestos Type(s)	# Structures Asbestos	# Structures Non-Asb.	Analytical Sensitivity (S/cc)	Concentration (S/mm²)	Concentration S/cc	Notes
AMS-001-A *040008279-0001*	1264	Amosite	1	4	0.0050	16.39	0.0050	Fiber is greater than 5 microns in length
AMS-002-A *040008279-0002*	1330	None Detected		0	0.0047	<16.39	<0.0047	
AMS-003-A *040008279-0003*	337	None Detected		0	0.0187	<16.39	<0.0187	
AMS-004-A *040008279-0004*	355	None Detected		0	0.0178	<16.39	<0.0178	
AMS-005-A *040008279-0005*	359	None Detected		0	0.0176	<16.39	<0.0176	
AMS-006-A *040008279-0006*	355	None Detected		0	0.0178	<16.39	<0.0178	
AMS-007-A *040008279-0007*	63	None Detected		0	0.1002	<16.39	<0.1002	
AMS-008-A *040008279-0008*	63	None Detected		0	0.0998	<16.39	<0.0998	

Anant Samudra
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: The laboratory is not responsible for data reported in structures/cc, which is dependent on volume collected by non-laboratory personnel. This report may not be duplicated, except in full, without written permission by EMSL Analytical, Inc. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report relates only to the samples reported above. Quality control data (including 95% confidence limits and laboratory and analysts' accuracy and precision) is available upon request.
Accredited for NVLAP PLM/TEM #101048-0, NY ELAP #10872

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn:	Linda Phillips/Dave Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID:	VERS96
		Customer PO:	
		Received:	05/26/00 12:17 PM
Fax:	703-642-6809 Phone: 703-642-6889		
Project:	**4601.005/EPA WIMSATT**	EMSL Order:	040008279
		EMSL Project ID:	
		Analysis Date:	5/29/2000

Fiber Analysis of Air Samples via NIOSH 7400, Revision 3, Issue 2, 8/15/94

Sample	*Location*	*Sample Date*	*Volume*	*Fibers*	*Fields*	*LOD (fib/cc)*	*Fibers/ mm²*	*Fibers/ cc*	*Notes*
AMS-001-A		5/25/2000	1264.40	16.0	100	0.002	20.38	0.006	
040008279-0001									
AMS-002-A		5/25/2000	1329.75	6.5	100	0.002	8.28	0.002	
040008279-0002									
AMS-003-A		5/25/2000	337.18	10.0	100	0.008	12.74	0.015	
040008279-0003									
AMS-004-A		5/25/2000	354.60	<5.5	100	0.008	<7.0	<0.008	
040008279-0004									
AMS-005-A		5/25/2000	358.52	<5.5	100	0.008	<7.0	<0.008	
040008279-0005									
AMS-006-A		5/25/2000	355.46	<5.5	100	0.008	<7.0	<0.008	
040008279-0006									
AMS-007-A		5/25/2000	63.00	<5.5	100	0.043	<7.0	<0.043	
040008279-0007									
AMS-008-A		5/25/2000	63.21	<5.5	100	0.043	<7.0	<0.043	
040008279-0008									
AMS-009-A		5/25/2000	0.00	<5.5	100		<7.0		Field Blank
040008279-0009									
AMS-010-A		5/25/2000	0.00	<5.5	100		<7.0		Field Blank
040008279-0010									
AMS-011-A		5/25/2000	0.00	<5.5	100		<7.0		Field Blank
040008279-0011									

Tom Beer
Analyst

Stephen Siegel, CIH
or other approved signatory

Limit of detection is 7 fibers/mm². The laboratory is not responsible for data reported in fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #10872)

PCM-1

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn:	Linda Phillips/Dave Nelson Versar Inc. 6850 Versar Center PO Box 1549 Springfield, VA 22151	Customer ID:	VERS96
		Customer PO:	
		Received:	05/26/00 12:17 PM
Fax:	703-642-6809 Phone: 703-642-6889		
Project:	**4601.005/EPA WIMSATT**	EMSL Order:	040008279
		EMSL Project ID:	
		Analysis Date:	5/29/2000

Fiber Analysis of Air Samples via NIOSH 7400, Revision 3, Issue 2, 8/15/94

Sample	*Location*	*Sample Date*	*Volume*	*Fibers*	*Fields*	*LOD (fib/cc)*	*Fibers/ mm²*	*Fibers/ cc*	*Notes*
AMS-012-A		5/25/2000	0.00	<5.5	100		<7.0		Field Blank
040008279-0012									

Tom Beer
Analyst

Stephen Siegel, CIH
or other approved signatory

Limit of detection is 7 fibers/mm². The laboratory is not responsible for data reported in fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #10872)

PCM-1

4610

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE
4621.005	EPA-VERMICULITE		Y / N

SAMPLERS: (Signature) David A Nelson (Printed) DAVID A. NELSON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PCM & TEM (EPA LEVEL II)	REMARKS
AMS-001-A	5/25/00				SEE AIR SAMPLE DATA	1	✓	
AMS-002-A					SHEET			
AMS-003-A								
AMS-004-A								
AMS-005-A								
AMS-006-A								
AMS-007-A								
AMS-008-A								
AMS-009-A								
AMS-010-A								
AMS-011-A								
AMS-012-A	✓				✓	✓	✓	

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
David A Nelson	5/25/00 1830				
(Printed) DAVID A. NELSON	5/25/00 1830	(Printed)	(Printed)		(Printed)
Relinquished by: (Signature)	**Date / Time**	**Received for Laboratory by:** (Signature) Sharon Cain	**Date / Time**	**Remarks** PCM & TEM EPA LEVEL II * REPORT FIBER SIZES *	
(Printed)		(Printed)			

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink)

05 MAY 26 PM 12:17

Versar Inc.

ASBESTOS AIR SAMPLE DATA

Versar Job No: 4601.005 | Client: EPA
Project Manager: LINDA PHILLIPS | Sample Location: WISMART
Date: 5/25/00 Shift: | Samples Collected by: D. NELSON
Collection Method: NIOSH 7400 / EPA LEVEL II | Analyze for: FIBERS / ASBESTOS
Sample Media: .45/.8 MCE 25 mm | Temp: 75° /Rel. Humid: 81%

SAMPLE DATA

Sample No.	AMS-001-A	AMS-002-A	AMS-003-A	AMS-004-A	AMS-005-A	AMS-006-A
Pump No.	1669	1679	1669	1679	1666	1663
Time On	0955	0955	1432	1432	1432	1432
Time Off	1210	1210	1508	1508	1508	1508
Total Time (min.)	135	135	36	36	36	36
Flow Rate (LPM)	9.366	9.850	9.366	9.850	9.959	9.874
Volume (liters)	1264.41	1329.75	337.176	354.60	358.52	355.46
Fibers/Fields						
Detection Limit						
Results f/cc						

Analyst						
QC Recounts (f/cc)						
QC Analyst						

RECEIVED 05MAY 26 PM 12:17

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AMS-001-A	INSIDE CONTAINMENT	5'	I	A	S	—	NA
AMS-002-A	INSIDE CONTAINMENT	5'	I	A	S	—	NA
AMS-003-A	INSIDE CONTAINMENT	5'	I	A	R	—	NA
AMS-004-A	INSIDE CONTAINMENT	5'	I	A	M	—	NA
AMS-005-A	OUTSIDE CONTAINMENT	5'	O	A	M	—	NA
AMS-006-A	OUTSIDE CONTAINMENT	5'	O	A	M	—	NA

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles Bi = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging MI - MIXING VERMICULITE
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments: AIR SAMPLE COLLECTED DURING MIXING OF SCHULTZ HORTICULTURAL VERMICULITE

Versar Inc.

ASBESTOS AIR SAMPLE DATA

Versar Job No. 4601.005
Project Manager: LINDA MULLINS
Date: 5/25/00 Shift:
Collection Method: NIOSH 7400/EPA LEVEL II
Sample Media: .45/.8 MCE 25 mm

Client: EPA
Sample Location: LUMUS #55
Samples Collected by: D. NELSON
Analyze for: FIBERS/ASBESTOS
Temp: 75° /Rel. Humid: 81%

SAMPLE DATA

Sample No.	AMS-007-A	AMS-008	AMS-009-A	AMS-010-A	AMS-011-A	AMS-012-A
Pump No.	584372	584333	—	—	—	
Time On	1435	1435	BLANK (.45)	BLANK (.45)	BLANK (.8)	BLANK (.8)
Time Off	1505	1505				
Total Time (min.)	30	30				
Flow Rate (LPM)	2.100	2.107				
Volume (liters)	63	63.21				
Fibers/Fields						
Detection Limit						
Results f/cc						

00 MAY 26 PM 12:17

Analyst						
QC Recounts (f/cc)						
QC Analyst						

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AMS-007-A	PERSONAL @ DAVID NELSON	BREATHING ZONE	I	P	M	—	NA
AMS-008-A	PERSONAL @ DAVID NELSON	BREATHING ZONE	I	P	M	—	NA

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles Bi = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging M - MIXING
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments:

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **4601.005**

Customer ID: VERS96
Customer PO:
Received: 05/27/00 9:41 AM

EMSL Order: 040008375
EMSL Project ID:
Analysis Date: 5/30/2000

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selected Area Electron Diffraction (SAED), and Energy Dispersive X-Ray Microanalysis (EDX) - Performed by EPA Level II Method.

Sample	Volume (liters)	Asbestos Type(s)	# Structures Asbestos	# Structures Non-Asb.	Analytical Sensitivity (S/cc)	Concentration (S/mm²)	Concentration S/cc	Notes
AMS-013A *040008375-0017*	359	None Detected		0	0.0176	<16.39	<0.0176	
AMS-014A *040008375-0018*	365	None Detected		0	0.0173	<16.39	<0.0173	
AMS-015A *040008375-0019*	355	None Detected		0	0.0178	<16.39	<0.0178	
AMS-016A *040008375-0020*	337	None Detected		0	0.0187	<16.39	<0.0187	
AMS-017A *040008375-0021*	67	Tremolite	1	2	0.0935	16.39	0.0935	Fiber is greater than 5 microns in length
AMS-018A *040008375-0022*	60	None Detected		0	0.1047	<16.39	<0.1047	
AMS-019A *040008375-0023*	378	None Detected		0	0.0167	<16.39	<0.0167	
AMS-020A *040008375-0024*	375	None Detected		0	0.0168	<16.39	<0.0168	
AMS-021A *040008375-0025*	276	None Detected		0	0.0229	<16.39	<0.0229	

Anant Samudra
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: The laboratory is not responsible for data reported in structures/cc, which is dependent on volume collected by non-laboratory personnel. This report may not be duplicated, except in full, without written permission by EMSL Analytical, Inc. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report relates only to the samples reported above. Quality control data (including 95% confidence limits and laboratory and analysts' accuracy and precision) is available upon request.
Accredited for NVLAP PLM/TEM #101048-0, NY ELAP #10872

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **4601.005**

Customer ID: VERS96
Customer PO:
Received: 05/27/00 9:41 AM

EMSL Order: 040008375
EMSL Project ID:
Analysis Date: 5/30/2000

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selected Area Electron Diffraction (SAED), and Energy Dispersive X-Ray Microanalysis (EDX) - Performed by EPA Level II Method.

Sample	Volume (liters)	Asbestos Type(s)	# Structures Asbestos	# Structures Non-Asb.	Analytical Sensitivity (S/cc)	Concentration (S/mm²)	Concentration S/cc	Notes
AMS-022A *040008375-0026*	328	Actinolite	5	0	0.0192	81.97	0.0961	This result is for all length fibers.
AMS-022A *040008375-0033*	328	Actinolite	4	0	0.0192	65.57	0.0769	This result is for fibers 5 microns a greater in length.
AMS-023A *040008375-0027*	67	Actinolite	8	0	0.0942	131.15	0.7536	This result is for all fiber lengths.
AMS-023A *040008375-0034*	67	Actinolite	7	0	0.0942	114.75	0.6594	This result is for fibers 5 microns a greater in length.
AMS-024A *040008375-0028*	61	Actinolite	6	0	0.1043	98.36	0.6255	This result for all fiber lengths.
AMS-024A *040008375-0035*	61	Actinolite	4	0	0.1043	65.57	0.4170	This result is for fibers 5 microns a greater in length.

Anant Samudra
Analyst

Stephen Siegel, CIH
or other approved signatory

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Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **4601.005**

Customer ID: VERS96
Customer PO:
Received: 05/27/00 9:41 AM

EMSL Order: 040008375
EMSL Project ID:
Analysis Date: 5/30/2000

Fiber Analysis of Air Samples via NIOSH 7400, Revision 3, Issue 2, 8/15/94

Sample	*Location*	*Sample Date*	*Volume*	*Fibers*	*Fields*	*LOD (fib/cc)*	*Fibers/ mm²*	*Fibers/ cc*	*Notes*
AMS-013-A *040008375-0001*		5/25/2000	358.52	<5.5	100	0.008	<7.0	<0.008	
AMS-014-A *040008375-0002*		5/25/2000	365.34	<5.5	100	0.007	<7.0	<0.007	
AMS-015-A *040008375-0003*		5/25/2000	354.60	34.0	100	0.008	43.31	0.047	
AMS-016-A *040008375-0004*		5/25/2000	337.18	18.5	100	0.008	23.57	0.027	
AMS-017-A *040008375-0005*		5/25/2000	67.47	51.0	100	0.040	64.97	0.371	
AMS-018-A *040008375-0006*		5/25/2000	60.30	15.0	100	0.045	19.11	0.122	
AMS-019-A *040008375-0007*		5/25/2000	378.40	9.5	100	0.007	12.1	0.012	
AMS-020-A *040008375-0008*		5/25/2000	375.21	8.0	100	0.007	10.19	0.011	
AMS-021-A *040008375-0009*		5/25/2000	276.09	<5.5	100	0.010	<7.0	<0.010	
AMS-022-A *040008375-0010*		5/25/2000	328.49	72.0	100	0.008	91.72	0.108	
AMS-023-A *040008375-0011*		5/25/2000	62.00	61.0	100	0.043	77.71	0.482	

Tom Beer
Analyst

Stephen Siegel, CIH
or other approved signatory

Limit of detection is 7 fibers/mm². The laboratory is not responsible for data reported in fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #10872)

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107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **4601.005**

Customer ID: VERS96
Customer PO:
Received: 05/27/00 9:41 AM

EMSL Order: 040008375
EMSL Project ID:
Analysis Date: 5/30/2000

Fiber Analysis of Air Samples via NIOSH 7400, Revision 3, Issue 2, 8/15/94

Sample	Location	Sample Date	Volume	Fibers	Fields	LOD (fib/cc)	Fibers/ mm²	Fibers/ cc	Notes
AMS-024-A		5/25/2000	60.54	42.5	100	0.044	54.14	0.344	
040008375-0012									
AMS-025-A		5/25/2000		<5.5	100		<7.0		Field Blank
040008375-0013									
AMS-026-A		5/25/2000		<5.5	100		<7.0		Field Blank
040008375-0014									
AMS-027-A		5/25/2000		<5.5	100		<7.0		Field Blank
040008375-0015									
AMS-028-A		5/25/2000		<5.5	100		<7.0		Field Blank
040008375-0016									

Tom Beer
Analyst

Stephen Siegel, CIH
or other approved signatory

Limit of detection is 7 fibers/mm². The laboratory is not responsible for data reported in fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #10872)

4595

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE Y / N
4601.005	EPA - LOS ANGELES		

SAMPLERS: (Signature) _____ (Printed) DAVID A. LEESON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PCM & TEM (EPA LEVEL II)	REMARKS
LAUS-013-A	5/26/00				SEE AIR SAMPLE	1	✓	
LAUS-014-A					DATA SHEET			
LAUS-015-A								
LAUS-016-A								
LAUS-017-A								
LAUS-018-A								
LAUS-019-A								
LAUS-020-A								
LAUS-021-A								
LAUS-022-A								
LAUS-023-A								
LAUS-024-A	✓					✓	✓	

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
(Printed) DAVID A. LEESON	5/26/00 1730	(Printed)	(Printed)		(Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
(Printed)		(Printed)			

Remarks: PCM & TEM (EPA LEVEL II)
* REPORT FIBER SIZES

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink)

4611

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE
1460.005	EPA DESIGNATE		Y / N

SAMPLERS: (Signature) _____ (Printed) DAVID A. NELSON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PCM & TEM (EPA LEVEL II)	REMARKS
AMS-025-A	5/26/00				SEE AIR SAMPLE	1	✓	
AMS-026-A					DATA SHEET	↓	↓	
AMS-027-A						↓	↓	
AMS-028-A	↓					↓	↓	

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
(Printed) DAVID A. NELSON	5/26/00 1730	(Printed)	(Printed)		(Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
(Printed)		(Printed)			

Remarks: PCM & TEM
EPA LEVEL II
* REPORT FIBER SIZES

05 MAY 27 AM 9:14

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink)

Versar Inc.

ASBESTOS AIR SAMPLE DATA

Versar Job No. 4601.005 | Client: EPA
Project Manager: LINDA PHILLIPS | Sample Location: LIBBY MT
Date: 05/26/00 Shift: | Samples Collected by: D. NELSON
Collection Method: NIOSH 7400 / EPA LEVEL II | Analyze for: FIBERS / ASBESTOS
Sample Media: 45/.8 MICE 25mm | Temp: 77° /Rel. Humid: 50%

SAMPLE DATA

Sample No.	AMS-013-A	AMS-014-A	AMS-015-A	AMS-016-A	AMS-017-A	AMS-018-A
Pump No.	1666	1663	1669	1679	534332	534340
Time On	1117	1117	1120	11:20	11:20	1120
Time Off	1153	1154	1156	11:56	11:50	1150
Total Time (min.)	36	37	36	36	30	30
Flow Rate (LPM)	9.959	9.874	9.850	9.366	2.249	2.010
Volume (liters)	358.52	365.338	354.60	337.176	67.47	60.3
Fibers/Fields						
Detection Limit						
Results f/cc						

Analyst						
QC Recounts (f/cc)						
QC Analyst						

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AMS-013-A	OUTSIDE CONTAINMENT	5'0	O	A	M	—	NA
AMS-014-A	OUTSIDE CONTAINMENT	5'0	O	A	M	—	NA
AMS-015-A	INSIDE CONTAINMENT	5'0	I	A	M	—	NA
AMS-016-A	INSIDE CONTAINMENT	5'0	I	A	M	—	NA
AMS-017-B	PERSONAL ON DAVID NELSON	BREATHING ZONE	I	P	M	—	NA
AMS-018-A	PERSONAL ON DAVID NELSON	BREATHING ZONE	I	P	M	—	NA

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles Bi = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging M - MIXING
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments: SAMPLES COLLECTED DURING MIXING OF HOFFMAN'S HOTKNIFE VERMICULITE

Versar INC.

ASBESTOS AIR SAMPLE DATA

Versar Job No. 4601.005
Project Manager: LINDA PHILLIPS
Date: 5/26/00 Shift:
Collection Method: NIOSH 7400/EPA LEVEL II
Sample Media: .45/.8 MCE 25mm

Client: EPA
Sample Location: WINDSOR
Samples Collected by: D. NELSON
Analyze for: FIBERS/ASBESTOS
Temp: 72° /Rel. Humid: 81%

SAMPLE DATA

Sample No.	AMS-019-A	AMS-020-A	AMS-021-A	AMS-022-A	AMS-023-A	AMS-024-A
Pump No.	16606	1663	16609	1679	584340	584332
Time On	1510	1510	1514	1514	1515	1515
Time Off	1548	1548	1551	1551	1545	1545
Total Time (min.)	38	38	37	37	30	30
Flow Rate (LPM)	9.959	9.874	7.462	8.878	2.084	2.018
Volume (liters)	378.442	375.212	276.09	328.486	62	60.54
Fibers/Fields						
Detection Limit						
Results f/cc						

Analyst						
QC Recounts (f/cc)						
QC Analyst						

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AMS-019-A	OUTSIDE CONTAINMENT	5'6	O	A	M	—	NA
AMS-020-A	OUTSIDE CONTAINMENT	5'6	O	A	M	—	NA
AMS-021-A	INSIDE CONTAINMENT	5'6	I	A	M	—	NA
AMS-022-A	INSIDE CONTAINMENT	5'0	I	A	M	—	NA
AMS-023-A	PERSONAL	BREATHING ZONE	I	P	M	—	NA
AMS-024-A	PERSONAL	BREATHING ZONE	I	P	M	—	NA

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles Bi = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments: SAMPLES COLLECTED DURING MIXING OF ZONOLITE®

Versar INC.

ASBESTOS AIR SAMPLE DATA

Versar Job No. 4661.005 | Client: CSX
Project Manager: DAVID PHILLIPS | Sample Location: WESTHAT
Date: 5/26/00 Shift: | Samples Collected by: D. VEESOR
Collection Method: LEAH 7400/EPA LEVEL II | Analyze for: FIBERS/ASBESTOS
Sample Media: .45/.3 MIL 25 MM | Temp: 72° /Rel. Humid: 50%

SAMPLE DATA

Sample No.	AWS-025-A	AWS-026-A	AWS-027-A	AWS-028-A		
Pump No.	BLANK	BLANK	BLANK	BLANK		
Time On	.8	.8	.45	.45		
Time Off						
Total Time (min.)						
Flow Rate (LPM)						
Volume (liters)						
Fibers/Fields						
Detection Limit						
Results f/cc						

Analyst						
QC Recounts (f/cc)						
QC Analyst						

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AWS-025-A	BLANK			B			
AWS-026-A	BLANK						
AWS-027-A	BLANK						
AWS-028-A	BLANK			V			

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles Bi = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments:

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: Linde Phillips/Dave Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: 4601.006/EPA Vermiculite

Customer ID: VERS96
Customer PO:
Received: 07/12/00 10:17 AM

EMSL Order: 040011455
EMSL Project ID:
Analysis Date: 7/13/2000

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selected Area Electron Diffraction (SAED), and Energy Dispersive X-Ray Microanalysis (EDX) - Performed by EPA Level II Method.

Sample	Volume (liters)	Asbestos Type(s)	# Structures Asbestos	# Structures Non-Asb.	Analytical Sensitivity (S/cc)	Concentration (S/mm²)	Concentration S/cc	Notes
AMS-040-A *040011455-0001*	1124	None Detected		0	0.0056	<16.39	<0.0056	
AMS-041-A *040011455-0002*	1182	None Detected		0	0.0053	<16.39	<0.0053	
AMS-042-A *040011455-0003*	403	None Detected		0	2.6341	<2755.20	<2.6341	Sample was analyzed by indirect prep, ash and resuspend. 2% of sample was filtered for analysis.
AMS-043-A *040011455-0004*	424	None Detected		0	2.5044	<2755.20	<2.5044	Sample was analyzed by indirect prep, ash and resuspend. 2% of sample was filtered for analysis.
AMS-044-A *040011455-0005*	448	None Detected		1	0.0141	<16.39	<0.0141	
AMS-045-A *040011455-0006*	444	None Detected		1	0.0142	<16.39	<0.0142	
AMS-047-A *040011455-0007*	66	None Detected		1	16.0428	<2755.20	<16.0428	Sample was analyzed by indirect prep, ash and resuspend. 2% of sample was filtered for analysis.

Debbie Little
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: The laboratory is not responsible for data reported in structures/cc, which is dependent on volume collected by non-laboratory personnel. This report may not be duplicated, except in full, without written permission by EMSL Analytical, Inc. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report relates only to the samples reported above. Quality control data (including 95% confidence limits and laboratory and analysts' accuracy and precision) is available upon request.
Accredited for NVLAP PLM/TEM #101046-0, NY ELAP #10872

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: Linda Phillips/Dave Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **4601.006/EPA Vermiculite**

Customer ID: VERS96
Customer PO:
Received: 07/12/00 10:17 AM

EMSL Order: 040011455
EMSL Project ID:
Analysis Date: 7/13/2000

Fiber Analysis of Air Samples via NIOSH 7400, Revision 3, Issue 2, 8/15/94

Sample	Location	Sample Date	Volume	Fibers	Fields	LOD (f/b/cc)	Fibers/ mm²	Fibers/ cc	Notes
AMS-040-A		7/11/2000	1124.00	<5.5	100	0.002	<7.0	<0.002	
040011455-0001									
AMS-041-A		7/11/2000	182.00	<5.5	100	0.015	<7.0	<0.015	
040011455-0002									
AMS-042-A		7/11/2000							Overloaded
040011455-0003									
AMS-043-A		7/11/2000							Overloaded
040011455-0004									
AMS-044-A		7/11/2000	448.15	<5.5	100	0.006	<7.0	<0.006	
040011455-0005									
AMS-045-A		7/11/2000	444.33	<5.5	100	0.006	<7.0	<0.006	
040011455-0006									
AMS-047-A		7/11/2000							Overloaded
040011455-0007									
AMS-048-A		7/11/2000	0.00	<5.5	100		<7.0		Field Blank
040011455-0008									
AMS-049-A		7/11/2000	0.00	<5.5	100		<7.0		Field Blank
040011455-0009									
AMS-050-A		7/11/2000	0.00	<5.5	100		<7.0		Field Blank
040011455-0010									
AMS-051-A		7/11/2000	0.00	<5.5	100		<7.0		Field Blank
040011455-0011									

Dave Stanhope
Analyst

Stephen Siegel, CIH
or other approved signatory

Limit of detection is 7 fibers/mm². The laboratory is not responsible for data reported in fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #10872)

PCM-1

4598

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE Y / N
4601.005	EPA - VERMICULITE		

SAMPLERS: (Signature) [signature]

(Printed) DAVID A. HESON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TEM (EPA LEVEL II)	REMARKS
BMS-040-B	7/11/00				SEE DTA SHEET	1	✓	
BMS-041-B					DATA SHEET			
BMS-042-B								
BMS-043-B								
BMS-044-B								
BMS-045-B								
BMS-046-B								
BMS-047-B								
BMS-048-B								
BMS-049-B								
BMS-050-B								
BMS-051-B	✓				✓	✓	✓	

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REGION 8
07 JUL 12 AM 10 17

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	7/11/00 1730				
(Printed) DAVID A. HESON	7/11/00 1730	(Printed)	(Printed)		(Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
(Printed)		(Printed)			

Remarks: PCM & TEM EPA LEVEL II

* REPORT FIBER SIZES 48-HOUR

07/14/2000 13:52 8568584960 EMSL ANALYTICAL INC PAGE 03

Versar

ASBESTOS AIR SAMPLE DATA

Versar Job No. 4601.005 Client: EPA
Project Manager: LINDA PHILLIPS Sample Location: WILMINGTON
Date: 7/11/00 Shift: FIRST Samples Collected by: DAVID NELSON
Collection Method: NIOSH 7400 / EPA LEVEL II Analyze for: FIBERS / ASBESTOS
Sample Media: .45 / MCE & SEMI CASSETTES Temp: 85° Rel. Humid: 58%

SAMPLE DATA

Sample No.	AMA-042-A	AMA-041-A	AMA-043-A	AMA-044-A	AMA-045-A	AMA-045-A
Pump No.	1669	1679	1669	1679	1666	1663
Time On	1130	1130	1421	1421	1412	1412
Time Off	1330	1330	1504	1504	1457	1457
Total Time (min.)	120	120	43	43	45	45
Flow Rate (LPM)	9.366	9.850	9.366	9.850	9.959	9.874
Volume (liters)	1124	1182	402.7	423.55	448.155	444.33
Fibers/Fields						
Detection Limit						
Results f/cc						

Analyst						
QC Recounts (f/cc)						
QC Analyst						

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AMA-042-A	INSIDE CONTAINMENT	5'6	I	A	S	-	NA
AMA-041-A	INSIDE CONTAINMENT	5'0	I	A	S	-	NA
AMA-043-A	INSIDE CONTAINMENT	5'0	I	A	M	-	NA
AMA-044-A	INSIDE CONTAINMENT	5'0	I	A	M	-	NA
AMA-045-A	OUTSIDE CONTAINMENT	5'0	O	A	M	-	NA
AMA-045-A	OUTSIDE CONTAINMENT	5'6	O	A	M	-	NA

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air M = MIXING
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles BI = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments: AREA SAMPLES COLLECTED DURING MIXING OF SCOTTS VERMICULITE - MATERIAL WAS VERY DUSTY.

Versar, Inc.

ASBESTOS AIR SAMPLE DATA

Versar Job No. 4401.005
Project Manager: KEVIN ANSELMO
Date: 7/11/00 Shift: EAST
Collection Method: NIOSH 7400 / EPA LEVEL II
Sample Media: .45/.8 um MCE 25mm CASSETTES

Client: EPA
Sample Location: DOWNSTAFF
Samples Collected by: DAVID NELSON
Analyze for: FIBERS/ASBESTOS
Temp: 85° /Rel. Humid: 58%

SAMPLE DATA

Sample No.	AMS-046-A	AMS-047-A	AMS-048-A	AMS-049-A	AMS-050-A	AMS-051-A
Pump No.	805	801	BLANK	BLANK	BLANK	BLANK
Time On	1421	1421	1425	1425	1425	1425
Time Off	1451	1451				
Total Time (min.)	30	30				
Flow Rate (LPM)	2.078	2.204				
Volume (liters)	62.34	66.12				
Fibers/Fields	VOID*					
Detection Limit						
Results f/cc						

Analyst						
QC Recounts (f/cc)						
QC Analyst						

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AMS-046-A	PERSONAL ON DAVID NELSON VOID*	BREATHING ZONE	I	P	M	—	NA
AMS-047-A	PERSONAL ON DAVID NELSON	BREATHING ZONE	I	P	M	—	NA
AMS-048-A	BLANK	—	O	B	M	—	NA
AMS-049-A	BLANK	—	O	B	M	—	NA
AMS-050-A	BLANK	—	O	B	M	—	NA
AMS-051-A	BLANK	—	O	B	M	—	NA

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles BI = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments: *TUBE BECAME DETACHED DURING SAMPLING PERIOD

L:\TEMPLATE\ASBESTOS\AASD.TMP

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: EPA-VERMICULITE

Customer ID: VERS96
Customer PO:
Received: 07/13/00 4:36 PM

EMSL Order: 040011572
EMSL Project ID:
Analysis Date: 7/13/2000

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selected Area Electron Diffraction (SAED), and Energy Dispersive X-Ray Microanalysis (EDX) - Performed by EPA Level II Method.

Sample	Volume (liters)	Asbestos Type(s)	# Structures Asbestos	# Structures Non-Asb.	Analytical Sensitivity (S/cc)	Concentration (S/mm²)	Concentration S/cc	Notes
AMS-052-A *040011572-0001*	423	None Detected		0	1.0047	<1103.19	<1.0047	Sample was analyzed by indirect prep, ash and resuspend. 5% of sample was filtered for analysis.
AMS-053-A *040011572-0002*	424	None Detected		0	1.0028	<1103.19	<1.0028	Sample was analyzed by indirect prep, ash and resuspend. 5% of sample was filtered for analysis.
AMS-054-A *040011572-0003*	418	None Detected		0	0.0151	<16.39	<0.0151	
AMS-055-A *040011572-0004*	415	None Detected		0	0.0152	<16.39	<0.0152	
AMS-056-A *040011572-0005*	85	None Detected		0	3.2868	<551.41	<3.2868	Sample was analyzed by indirect prep, ash and resuspend. 10% of sample was filtered for analysis.
AMS-057-A *040011572-0006*	65	None Detected		0	6.5605	<1103.19	<6.5605	Sample was analyzed by indirect prep, ash and resuspend. 5% of sample was filtered for analysis.
AMS-058-A *040011572-0007*	403	None Detected		0	0.5271	<551.41	<0.5271	Sample was analyzed by indirect prep, ash and resuspend. 10% of sample was filtered for analysis.
AMS-059-A *040011572-0008*	424	None Detected		0	0.5012	<551.41	<0.5012	Sample was analyzed by indirect prep, ash and resuspend. 10% of sample was filtered for analysis.
AMS-060-A *040011572-0009*	418	None Detected		0	0.0151	<16.39	<0.0151	

Anant Samudra
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: The laboratory is not responsible for data reported in structures/cc, which is dependent on volume collected by non-laboratory personnel. This report may not be duplicated, except in full, without written permission by EMSL Analytical, Inc. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report relates only to the samples reported above. Quality control data (including 95% confidence limits and laboratory and analysts' accuracy and precision) is available upon request.
Accredited for NVLAP PLM/TEM #101046-0, NY ELAP #10872
TEM Level II-1

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: EPA-VERMICULITE

Customer ID: VERS96
Customer PO:
Received: 07/13/00 4:36 PM

EMSL Order: 040011572
EMSL Project ID:
Analysis Date: 7/13/2000

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selected Area Electron Diffraction (SAED), and Energy Dispersive X-Ray Microanalysis (EDX) - Performed by EPA Level II Method.

Sample	Volume (liters)	Asbestos Type(s)	# Structures Asbestos	# Structures Non-Asb.	Analytical Sensitivity (S/cc)	Concentration (S/mm²)	Concentration S/cc	Notes
AMS-061-A *040011572-0010*	415	None Detected		0	0.0152	<16.39	<0.0152	
AMS-062-A *040011572-0011*	61	None Detected		0	3.4654	<551.41	<3.4654	Sample was analyzed by indirect prep, ash and resuspend.10% of sample was filtered for analysis.
AMS-063-A *040011572-0012*	62	None Detected		0	3.4302	<551.41	<3.4302	Sample was analyzed by indirect prep, ash and resuspend. 10% of sample was filtered for analysis.

Anant Samudra
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: The laboratory is not responsible for data reported in structures/cc, which is dependent on volume collected by non-laboratory personnel. This report may not be duplicated, except in full, without written permission by EMSL Analytical, Inc. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report relates only to the samples reported above. Quality control data (including 95% confidence limits and laboratory and analysts' accuracy and precision) is available upon request.
Accredited by NVLAP PLM/TEM #101048-0, NY ELAP #10872

TEM Level II-1

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4860 Email: asiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: EPA-VERMICULITE

Customer ID: VERS96
Customer PO:
Received: 07/13/00 4:36 PM

EMSL Order: 040011572
EMSL Project ID:
Analysis Date: 7/13/2000

Fiber Analysis of Air Samples via NIOSH 7400, Revision 3, Issue 2, 8/15/94

Sample	Location	Sample Date	Volume	Fibers	Fields	LOD (fib/cc)	Fibers/ mm²	Fibers/ cc	Notes
AMS-052-A *040011572-0001*		7/13/2000							Overloaded
AMS-053-A *040011572-0002*		7/13/2000							Overloaded
AMS-054-A *040011572-0003*		7/13/2000	418.28	13.0	100	0.006	16.56	0.015	
AMS-055-A *040011572-0004*		7/13/2000	414.71	12.0	100	0.006	15.29	0.014	
AMS-056-A *040011572-0005*		7/13/2000							Overloaded
AMS-057-A *040011572-0006*		7/13/2000							Overloaded
AMS-058-A *040011572-0007*		7/13/2000							Overloaded
AMS-059-A *040011572-0008*		7/13/2000							Overloaded
AMS-060-A *040011572-0009*		7/13/2000	418.28	7.0	100	0.006	8.92	0.008	
AMS-061-A *040011572-0010*		7/13/2000	414.71	10.5	100	0.006	13.38	0.012	
AMS-062-A *040011572-0011*		7/13/2000							Overloaded

Tom Beer
Analyst

Stephen Siegel, CIH
or other approved signatory

Limit of detection is 7 fibers/mm². The laboratory is not responsible for data reported in fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #10872)

PCM-1

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: slegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: EPA-VERMICULITE

Customer ID: VERS96
Customer PO:
Received: 07/13/00 4:36 PM

EMSL Order: 040011572
EMSL Project ID:
Analysis Date: 7/13/2000

Fiber Analysis of Air Samples via NIOSH 7400, Revision 3, Issue 2, 8/15/94

Sample	Location	Sample Date	Volume	Fibers	Fields	LOD (f/b/cc)	Fibers/ mm²	Fibers/ cc	Notes
AMS-063-A *040011572-0012*		7/13/2000							Overloaded
AMS-064-A *040011572-0013*		7/13/2000	0.00	<5.5	100		<7.0		Field Blank
AMS-065-A *040011572-0014*		7/13/2000	0.00	<5.5	100		<7.0		Field Blank
AMS-066-A *040011572-0015*		7/13/2000	0.00	<5.5	100		<7.0		Field Blank
AMS-067-A *040011572-0016*		7/13/2000	0.00	<5.5	100		<7.0		Field Blank

Steve Siegel
Analyst

Stephen Siegel, CIH
or other approved signatory

Limit of detection is 7 fibers/mm². The laboratory is not responsible for data reported in fibers/cc, which is dependant on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #10872)

PCM-1

4613

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO. 460005 | PROJECT NAME EPA-VERMICULITE | PARAMETERS | INDUSTRIAL HYGIENE SAMPLE Y / N

SAMPLERS: (Signature) [signature] (Printed) David D. Hesson

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PCM & TEM (EPA LEVEL II)	REMARKS
DMS-052-A	7/12/00				SEE AIR SAMPLE	1	✓	
DMS-053-A					DATA SHEET			
DMS-054-A								
DMS-055-A								
DMS-056-A								
DMS-057-A								
DMS-058-A								
DMS-059-A								
DMS-060-A								
DMS-061-A								
DMS-062-A								
DMS-063-A	✓				✓	✓		

07 JUL 13 AM 10:25

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	7/12/00 1700				
(Printed) David D. Hesson	7/12/00 1700	(Printed)	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
(Printed)		(Printed)		PCM & TEM - EPA LEVEL II *REPORT FIBER SIZES 24-HOUR TURNAROUND

Versar

ASBESTOS AIR SAMPLE DATA

Versar Job No. 4601.005
Project Manager: LINDA MORITAS
Date: 7/12/00 Shift: FIRST
Collection Method: NIOSH 7400 / EPA LEVEL II
Sample Media: .45 µm MCE 25 mm CASSETTES

Client: EPA
Sample Location: OUTLOOK III
Samples Collected by: DAVID A. NELSON
Analyze for: FIBERS / ASBESTOS
Temp: 85° /Rel. Humid: 45%

SAMPLE DATA

Sample No.	AMS-058-A	AMS-059-A	AMS-060-A	AMS-061-A	AMS-062-B	AMS-063-B
Pump No.	1669	1679	1666	1663	803	802
Time On	1355	1355	1354	1354	1356	1356
Time Off	1438	1438	1436	1436	1426	1426
Total Time (min.)	43	43	42	42	30	30
Flow Rate (LPM)	9.366	9.850	9.959	9.374	2.042	2.063
Volume (liters)	402.738	423.55	418.278	414.708	61.26	61.89
Fibers/Fields						
Detection Limit						
Results f/cc						

Analyst						
QC Recounts (f/cc)						
QC Analyst						

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AMS-058-A	INSIDE CONTAINMENT	5'0	I	A	M	-	NA
AMS-059-A	INSIDE CONTAINMENT	5'0	I	A	M	-	NA
AMS-060-A	OUTSIDE CONTAINMENT	5'0	O	A	M	-	NA
AMS-061-A	OUTSIDE CONTAINMENT	5'0	O	A	M	-	NA
AMS-062-B	PERSONAL ON DAVID NELSON	BREATHING ZONE	I	P	M	-	NA
AMS-063-B	PERSONAL ON DAVID NELSON	BREATHING ZONE	I	P	M	-	NA

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles BI = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments: SAMPLE COLLECTION TOOK PLACE DURING MIXING OF COUNTRY COTTAGE HORTICULTURAL VERMICULITE

Versar

ASBESTOS AIR SAMPLE DATA

Versar Job No. 4601.005 | Client: EPA
Project Manager: LINDA PHILLIPS | Sample Location: WEMISATT
Date: 7/12/00 Shift: FIRST | Samples Collected by: DAVID NELSON
Collection Method: NIOSH 7400 / EPA LEVEL II | Analyze for: FIBERS/ASBESTOS
Sample Media: 45/.8um MCE 25mm CASSETTES | Temp: 85° /Rel. Humid: 95%

SAMPLE DATA

Sample No.	AMS-052-A	AMS-053-A	AMS-054-A	AMS-055-A	AMS-056-A	AMS-057-A
Pump No.	1669	1679	1666	1663	803	802
Time On	1034	1034	1033	1033	1037	1037
Time Off	1117	1117	1115	1115	1107	1107
Total Time (min.)	43	43	42	42	30	30
Flow Rate (LPM)	9.366	9.850	9.859	9.874	2.153	2.158
Volume (liters)	402.738	423.55	413.278	414.708	64.59	64.74
Fibers/Fields						
Detection Limit						
Results f/cc						

Analyst						
QC Recounts (f/cc)						
QC Analyst						

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AMS-052-A	INSIDE CONTAINMENT	5b	I	A	M	-	NA
AMS-053-A	INSIDE CONTAINMENT	5b	I	A	M	-	NA
AMS-054-A	OUTSIDE CONTAINMENT	5b	O	A	M	-	NA
AMS-055-A	OUTSIDE CONTAINMENT	5b	O	A	M	-	NA
AMS-056-A	PERSONAL ON DAVID NELSON	BREATHING ZONE	I	P	M	-	NA
AMS-057-A	PERSONAL ON DAVID NELSON	BREATHING ZONE	I	P	M	-	NA

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air.
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles Bi = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments: SAMPLE COLLECTION TOOK PLACE DURING MIXING OF JUNGLE GROWTH VERMICULITE

L:\TEMPLATE\ASBESTOS\AASD.TMP

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **#4601.005/EPA-Vermiculite**

Customer ID: VERS96
Customer PO:
Received: 07/14/00 10:30 AM

EMSL Order: 040011640
EMSL Project ID:
Analysis Date: 7/15/00

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selected Area Electron Diffraction (SAED), and Energy Dispersive X-Ray Microanalysis (EDX) - Performed by EPA Level II Method.

Sample	Volume (liters)	Asbestos Type(s)	# Structures Asbestos	# Structures Non-Asb.	Analytical Sensitivity (S/cc)	Concentration (S/mm²)	Concentration S/cc	Notes
AMS-068-A *040011640-0001*	403	None Detected		0	0.0157	<16.39	<0.0157	
AMS-069-A *040011640-0002*	424	None Detected		0	0.0149	<16.39	<0.0149	
AMS-070-A *040011640-0003*	418	None Detected		0	0.0151	<16.39	<0.0151	
AMS-071-A *040011640-0004*	415	None Detected		0	0.0152	<16.39	<0.0152	
AMS-072-A *040011640-0005*	58	None Detected		0	0.1096	<16.39	<0.1096	
AMS-073-A *040011640-0006*	60	None Detected		0	0.1052	<16.39	<0.1052	

Ron Mahoney
Analyst

Stephen Siegel

Stephen Siegel, CIH
or other approved signatory

Disclaimers: The laboratory is not responsible for data reported in structures/cc, which is dependent on volume collected by non-laboratory personnel. This report may not be duplicated, except in full, without written permission by EMSL Analytical, Inc. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report relates only to the samples reported above. Quality control data (including 95% confidence limits and laboratory and analysts' accuracy and precision) is available upon request.
Accredited for NVLAP PLM/TEM #101048-0, NY ELAP #10872

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **#4601.005/EPA-Vermiculite**

Customer ID: VERS96
Customer PO:
Received: 07/14/00 10:30 AM

EMSL Order: 040011640
EMSL Project ID:
Analysis Date: 7/14/00

Fiber Analysis of Air Samples via NIOSH 7400, Revision 3, Issue 2, 8/15/94

Sample	*Location*	*Sample Date*	*Volume*	*Fibers*	*Fields*	*LOD (fib/cc)*	*Fibers/ mm²*	*Fibers/ cc*	*Notes*
AMS-068-A *040011640-0001*		7/13/00	402.70	14.0	100	0.007	17.83	0.017	
AMS-069-A *040011640-0002*		7/13/00	423.60	17.5	100	0.006	22.29	0.020	
AMS-070-A *040011640-0003*		7/13/00	418.30	<5.5	100	0.006	<7.0	<0.006	
AMS-071-A *040011640-0004*		7/13/00	414.70	<5.5	100	0.006	<7.0	<0.006	
AMS-072-A *040011640-0005*		7/13/00	57.60	5.5	100	0.047	7.01	<0.047	
AMS-073-A *040011640-0006*		7/13/00	60.00	9.0	100	0.045	11.46	0.074	
AMS-074-A *040011640-0007*		7/13/00	0.00	<5.5	100		<7.0		
AMS-075-A *040011640-0008*		7/13/00	0.00	<5.5	100		<7.0		
AMS-076-A *040011640-0009*		7/13/00	0.00	<5.5	100		<7.0		
AMS-077-A *040011640-0010*		7/13/00	0.00	<5.5	100		<7.0		

Stephen Siegel

Tom Beer
Analyst

Stephen Siegel, CIH
or other approved signatory

Limit of detection is 7 fibers/mm². The laboratory is not responsible for data reported in fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #10872)

PCM-1

4614

Versar

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME	PARAMETERS	INDUSTRIAL HYGIENE SAMPLE Y / N
4609.005	EPA - VERMICULITE		

SAMPLERS: (Signature) [signature] (Printed) DAVID A. NELSON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PCM & TEM / EPA LEVEL II	REMARKS
DMS-068-D	7/13/00				SEE DAS SAMPLE	1	✓	
DMS-069-D					DATA SHEET			
DMS-070-D								
DMS-071-D								
DMS-072-D								
DMS-073-D								
DMS-074-D								
DMS-075-D								
DMS-076-D								
DMS-077-D	✓				✓	✓	✓	

07 JUL 14 AM 8:30

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	7/13/00 1730				
(Printed) DAVID A. NELSON	7/13/00 1730	(Printed)	(Printed)		(Printed)

Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks
		[signature]		PCM & TEM EPA LEVEL II
(Printed)		(Printed) Sharon Carson		* REPORT FIBER SIZES 24-HOUR TURNAROUND

04001/640

Versar Inc.

ASBESTOS AIR SAMPLE DATA

0400 11640

Versar Job No. 4601.005
Project Manager: LINDA PHILLIPS
Date: 7/13/00 Shift: FIRST
Collection Method: NIOSH 7400 / EPA LEVEL II
Sample Media: .45/.8um MCE 25mm CASSETTES

Client: EPA
Sample Location: WILMSATT
Samples Collected by: DAVID NELSON
Analyze for: FIBERS/ASBESTOS
Temp: 76° /Rel. Humid: 62%

SAMPLE DATA

Sample No.	AMS-068-A	AMS-069-A	AMS-070-A	AMS-071-A	AMS-072-A	AMS-073-A
Pump No.	1669	1679	1666	1663	803	802
Time On	1500	1500	1458	1458	1502	1502
Time Off	1543	1543	1540	1540	1532	1532
Total Time (min.)	43	43	42	42	30	30
Flow Rate (LPM)	9.366	9.850	9.959	9.874	1.921	2.00
Volume (liters)	402.738	423.55	418.278	414.708	57.63	60.0
Fibers/Fields						
Detection Limit						
Results f/cc						

Analyst						
QC Recounts (f/cc)						
QC Analyst						

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AMS-068-A	INSIDE CONTAINMENT	5'0	I	A	M	—	NA
AMS-069-A	INSIDE CONTAINMENT	5'0	I	A	M	—	NA
AMS-070-A	OUTSIDE CONTAINMENT	5'0	O	A	M	—	NA
AMS-071-A	OUTSIDE CONTAINMENT	5'0	O	A	M	—	NA
AMS-072-A	PERSONAL ON DAVID NELSON	BREATHING ZONE	I	P	M	—	NA
AMS-073-A	PERSONAL ON DAVID NELSON	BREATHING ZONE	I	P	M	—	NA

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air M = MIXING
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles Bi = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments: SAMPLE COLLECTION TOOK PLACE DURING MIXING OF KELLOG'S VERMICULITE - MATERIAL PRODUCED MODERATE DUST

Versar Inc.

ASBESTOS AIR SAMPLE DATA

Versar Job No. 4601.005
Project Manager: LINO MATTEOS
Date: 7/13/00 Shift: FIRST
Collection Method: NIOSH 7400 / EPA LEVEL II
Sample Media: .45/.8 um MCE 25 mm CASSETTES

Client: EPA
Sample Location: LEWISBTT
Samples Collected by: DAVID WEESON
Analyze for: FIBERS / ASBESTOS
Temp: 76° /Rel. Humid: 62%

SAMPLE DATA

Sample No.	BWS-074-B	BWS-075-B	BWS-076-B	BWS-077-B		
Pump No.	BLANK	BLANK	BLANK	BLANK		
Time On	.45 um	.45 um	.8 um	.8 um		
Time Off						
Total Time (min.)						
Flow Rate (LPM)						
Volume (liters)						
Fibers/Fields						
Detection Limit						
Results f/cc						

Analyst						
QC Recounts (f/cc)						
QC Analyst						

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
BWS-074-B	BLANK	-	O	B	M	-	NA
BWS-075-B	BLANK	-	O	B	M	-	NA
BWS-076-B	BLANK	-	O	B	M	-	NA
BWS-077-B	BLANK	-	O	B	M	-	NA

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air M = MIXED
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles Bi = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments: _____

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4960 Email: ssiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **EPA Vermiculite/4601.005**

Customer ID: VERS96
Customer PO:
Received: 06/02/00 10:54 AM

EMSL Order: 040008597
EMSL Project ID:
Analysis Date: 6/3/2000

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selected Area Electron Diffraction (SAED), and Energy Dispersive X-Ray Microanalysis (EDX) - Performed by EPA Level II Method.

Sample	Volume (liters)	Asbestos Type(s)	# Structures Asbestos	# Structures Non-Asb.	Analytical Sensitivity (S/cc)	Concentration (S/mm²)	Concentration S/cc	Notes
029A *040008597-0012*	677	None Detected		0	0.0093	<16.39	<0.0093	
030A *040008597-0013*	676	None Detected		0	0.0093	<16.39	<0.0093	preliminary
031A *040008597-0014*	408	None Detected		1	0.0155	<16.39	<0.0155	preliminary
032A *040008597-0015*	407	None Detected		2	0.0155	<16.39	<0.0155	perimeter
033A *040008597-0016*	406	Overloaded						perimeter
034A *040008597-0017*	90	None Detected		12	0.0702	<16.39	<0.0702	perimeter
035A *040008597-0018*	88	None Detected		3	0.0718	<16.39	<0.0718	perimeter

Debbie Little
Analyst

Stephen Siegel, CIH
or other approved signatory

Disclaimers: The laboratory is not responsible for data reported in structures/cc, which is dependent on volume collected by non-laboratory personnel. This report may not be duplicated, except in full, without written permission by EMSL Analytical, Inc. This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report relates only to the samples reported above. Quality control data (including 95% confidence limits and laboratory and analysts' accuracy and precision) is available upon request.
Accredited for NVLAP PLM/TEM #101048-0, NY ELAP #10872

EMSL Analytical, Inc.
107 Haddon Ave., Westmont, NJ 08108
Phone: (609) 858-4800 Fax: (609) 858-4860 Email: ssiegel@EMSL.com

Attn: David Nelson
Versar Inc.
6850 Versar Center
PO Box 1549
Springfield, VA 22151
Fax: 703-642-6809 Phone: 703-642-6889
Project: **EPA Vermiculite/4801.006**

Customer ID: VERS96
Customer PO:
Received: 06/02/00 10:54 AM

EMSL Order: 040008597
EMSL Project ID:
Analysis Date: 6/2/2000

Fiber Analysis of Air Samples via NIOSH 7400, Revision 3, Issue 2, 8/15/94

Sample	Location	Sample Date	Volume	Fibers	Fields	LOD (fib/cc)	Fibers/ mm²	Fibers/ cc	Notes
029A *040008597-0001*		6/1/2000	676.92	<5.5	100	0.004	<7.0	<0.004	
030A *040008597-0002*		6/1/2000	675.54	<5.5	100	0.004	<7.0	<0.004	
031A *040008597-0003*		6/1/2000	408.01	9.0	100	0.007	11.46	0.011	
032A *040008597-0004*		6/1/2000	407.18	11.0	100	0.007	14.01	0.013	
033A *040008597-0005*		6/1/2000							Overloaded
034A *040008597-0006*		6/1/2000							Overloaded
035A *040008597-0007*		6/1/2000	87.87	24.0	100	0.031	30.57	0.134	
036A *040008597-0008*		6/1/2000	0.00	<5.5	100		<7.0		Field Blank
037A *040008597-0009*		6/1/2000	0.00	<5.5	100		<7.0		Field Blank
038A *040008597-0010*		6/1/2000	0.00	<5.5	100		<7.0		Field Blank
039A *040008597-0011*		6/1/2000	0.00	<5.5	100		<7.0		Field Blank

Dave Stanhope
Analyst

Stephen Siegel, CIH
or other approved signatory

Limit of detection is 7 fibers/mm². The laboratory is not responsible for data reported in fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.
Analysis performed by EMSL Westmont (NY State ELAP #10872)

PCM-1

Versar

4604

CHAIN OF CUSTODY RECORD

PROJECT NO. 4691.005 | PROJECT NAME EPA VERMICULITE

SAMPLERS: (Signature) | (Printed) DAVID A. NELSON

FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	PARAMETERS: PCM & TEM (EPA LEVEL II)	REMARKS
AMS-029-A	6/1/00				SEE DFR SAMPLE	1	✓	
AMS-030-A					DATA SHEET			
AMS-031-A								
AMS-032-A								
AMS-033-A								
AMS-034-A								
AMS-035-A								
AMS-036-A								
AMS-037-A								
AMS-038-A								
AMS-039-A	✓				✓	✓	✓	

INDUSTRIAL HYGIENE SAMPLE: Y / N

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
(Printed) DAVID A. NELSON	6/1/00 1900	(Printed)	(Printed)		(Printed)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks: PCM & TEM EPA LEVEL II 48-HOUR TURN-AROUND * REPORT EDGE SIZES *	
(Printed)		(Printed) Sherm Carson			

06 JUN -2 AM 10:54

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink)

Versar Inc.

ASBESTOS AIR SAMPLE DATA

Versar Job No. 4601.005
Project Manager: LINDA PHILLIPS
Date: 6/1/00 Shift:
Collection Method: NIOSH 7400/EPA LEVEL II
Sample Media: .8 um/.45 mcE 25 mm CASSETTES

Client: EPA
Sample Location: 6102 FRANKLIN BLVD
Samples Collected by: [illegible]
Analyze for: PCM/ASBESTOS
Temp: 88° /Rel. Humid: 52%
WIND W @ 8 mph

SAMPLE DATA

Sample No.	AMS-029-A	AMS-030-A	AMS-031-A	AMS-032-A	AMS-033-A	AMS-034-A
Pump No.	1666	1679	1666	1679	1669	805
Time On	1351	1352	1533	1534	1535	1533
Time Off	1504	1505	1617	1618	1619	1617
Total Time (min.)	73	73	44	44	44	44
Flow Rate (LPM)	9.273	9.254	9.273	9.254	9.232	2.044
Volume (liters)	676.92	675.54	408.01	407.176	406.208	89.936
Fibers/Fields						
Detection Limit						
Results f/cc						

Analyst						
QC Recounts (f/cc)						
QC Analyst						

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AMS-029-A	PRELIMINARY	5'0	O	A	S	-	NA
AMS-030-A	PRELIMINARY	5'0	O	A	S	-	NA
AMS-031-A	PERIMETER - DOWNWIND FROM VERMICULITE MIXING	5'0	O	A	M	-	NA
AMS-032-A	PERIMETER - DOWNWIND FROM VERMICULITE MIXING	5'0	O	A	M	-	NA
AMS-033-A	PERIMETER - DOWNWIND FROM VERMICULITE MIXING	5'0	O	A	M	-	NA
AMS-034-A	PERSONAL COLLECTED DURING VERMICULITE MIXING ACTIVITY	BREATHING ZONE	I	P	M	-	NA
D							

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air M=MIXING
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles BI = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments: SAMPLES COLLECTED DURING MIXING OF ZONOLITE® VERMICULITE

L:\TEMPLATE\ASBESTOS\AASD.TMP

Analyst 6/3/00.

Versar

ASBESTOS AIR SAMPLE DATA

Versar Job No. 4601.005
Project Manager: EMMA PHILLIPS
Date: 6/1/00 Shift:
Collection Method: NIOSH 7400/EPA LEVEL II
Sample Media: .8um/.45 MCE 25mm CASSETTES

Client: EPA
Sample Location: 6102 FERNLEIGH BLVD
Samples Collected by: JAMES MURRAY/DAVID LUCAS
Analyze for: FIBERS/ASBESTOS
Temp: 66° /Rel. Humid: 52%
WIND WE 8 mph

SAMPLE DATA

Sample No.	AMS-035-A	AMS-036-B	AMS-037-B	AMS-038-B	AMS-039-B		
Pump No.	802	BLANK	BLANK	BLANK	BLANK		
Time On	1533	.45um	.45um	.8um	.8um		
Time Off	1617						
Total Time (min.)	44						
Flow Rate (LPM)	1.997						
Volume (liters)	87.868						
Fibers/Fields							
Detection Limit							
Results f/cc							

Analyst							
QC Recounts (f/cc)							
QC Analyst							

SAMPLE LOCATION

Sample No.		HT	LOC	TYP	PH	ABT	SAM
AMS-035-A	REMOVAL COLLECTED ON D. NELSON DURING VERMICULITE MIXING ACTIVITY	BREATHING ZONE	I	P	M	—	NA
AMS-036-B	BLANK	—	O	B	M	—	—
AMS-037-B	BLANK	—	O	B	M	—	—
AMS-038-B	BLANK	—	O	B	M	—	—
AMS-039-B	BLANK	—	O	B	M	—	—

Height (HT)
Location (LOC): I = Inside Work area O = Outside work area
Type (TYP): G = General Area P = Personal A = Ambient B = Field Blank
Phase (PH): S = Pre-Start R = Removal E = Establish Containment C = Cleanup F = Final air M = MIXING
Abatement (ABT): FP = Fireproofing CT = Ceiling Tiles FT = Floor Tiles BI = Boiler
TP = Transite Panel AC = Acoustical Ceiling Texture M = Adhesive Mastics
R = Roofing Materials PI = Pipe Lagging
Sampling (SAM): AG = Aggressive NA = Non-Aggressive

Note: All Personal Samples Must Have Worker Name and Social Security Number.

Comments: SAMPLES COLLECTED DURING MIXING OF ZONOLITE® VERMICULITE