Draft
Engineering Evaluation/Cost Analysis for the Horse Mountain Mine and Mill Site Six Rivers National Forest Humboldt County, California

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Acronyms and Abbreviations

ATV	all-terrain vehicle
ARARs	applicable or relevant and appropriate requirements
BLM	Bureau of Land Management
BMP	best management practice
CAMUs	corrective action management units
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	chemicals of concern
COPCs	chemicals of potential concern
CTR	California Toxics Rule
DWR	California Department of Water Resources
Eco-SSLs	ecological soil screening levels
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
ERRG	Engineering/Remediation Resources Group, Inc.
Forest Service	U.S. Department of Agriculture Forest Service Region 5
ISO	International Organization for Standardization
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NCRWQCB	North Coast Regional Water Quality Control Board
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination Systems
NRCS	National Resources Conservation Service
NTCRA	non-time-critical removal action

Acronyms and Abbreviations *(continued)*

PA/SI	Preliminary Assessment/Site Inspection
PECs	probable effects concentrations
PLM	polarized light microscopy
PPE	personal protective equipment
PRP	Potentially Responsible Party
QC	quality control
RCRA	Resource Conservation and Recovery Act
RAOs	removal action objectives
RMC	risk management criteria
RSL	Regional Screening Level
SCEM	site conceptual exposure model
SQuiRTs	Screening Quick Reference Tables
SIA	Special Interest Areas
SPLP	synthetic precipitation leaching procedure
SRE	streamlined risk evaluation
SWRCB	State Water Resources Control Board
TBC	to be considered
USC	United States Code
USDA	U.S. Department of Agriculture
Weston	Weston Solutions, Inc.
µg/L	micrograms per liter
§	Section

Executive Summary

Engineering/Remediation Resources Group, Inc. conducted an engineering evaluation/cost analysis (EE/CA) for the Horse Mountain Mine and Mill Site in the Six Rivers National Forest, approximately 7 miles southwest of Willow Creek, in Humboldt County, California. The purpose of this EE/CA is to develop and analyze removal action alternatives to aid the U.S. Department of Agriculture Forest Service in reclamation of the site.

Based on the results of a previous investigation, as well as additional sampling conducted under this EE/CA, metals in mine waste rock and tailings piles (i.e., source materials) have been identified as posing unacceptable risk to human health and the environment. As a result, a removal action is necessary to minimize the risks associated with metals in source materials at the site.

The following preliminary removal action objectives (RAOs) were developed for the site to reduce the risks to human health:

- Reduce exposure of humans and wildlife to metals in source materials (i.e., waste rock and tailings) to acceptable levels.
- Reduce the release of metals eroding from source materials (i.e., waste rock and tailings).

This EE/CA considered preliminary cleanup levels that are protective of both human health and the environment based on the recreational uses of the site and the sensitive ecosystems at and downstream of the site. As a result, removal action alternatives were developed and evaluated for waste piles, settling ponds and foundations at three site areas: the Open Pit, the Adit/Pond, and the Mill Site.

The following removal action alternatives were evaluated in the EE/CA to address the RAOs:

1. Alternative 1: No Action
2. Alternative 2A: Excavation and Onsite Encapsulation of Source Materials (one encapsulation unit, soil cover)
3. Alternative 2B: Excavation and Onsite Encapsulation of Source Materials (one encapsulation unit, asphalt cover)
4. Alternative 3A: Excavation and Onsite Encapsulation of Source Materials (two encapsulation units, soil cover)
5. Alternative 3B: Excavation and Onsite Encapsulation of Source Materials (two encapsulation units, asphalt)
6. Alternative 4: Excavation and Offsite Disposal of Source Materials

Each alternative was analyzed for effectiveness, implementability, and cost. Following the analysis of alternatives, a comparative analysis of all alternatives was conducted and the recommended removal action alternative was selected. Based on the detailed and comparative analyses, **Alternative 2A, Excavation of Source Materials and Onsite Encapsulation (one encapsulation unit, soil cover),** was recommended as the preferred remedy for the site. Alternative 2A was recommended because (1) it achieves the RAOs, (2) it meets the applicable or relevant and appropriate requirements, and (3) is more cost-effective than the other alternatives, except for Alternative 3A, with approximately equivalent costs, and Alternative 1 (no action).

The recommended removal action alternative has the following primary components:

- A topographic survey would be conducted to establish the volume of waste to be removed.
- An engineering design would be completed for an onsite encapsulation unit and restoration of the excavations and creek bank. The design would identify an appropriate site for the onsite encapsulation unit and outline required testing to be performed prior to building the encapsulation unit. The onsite encapsulation design would be reviewed by a professional engineer, as well as the applicable regulatory agencies, prior to mobilization to the site.
- An evaluation of strategies for reducing the risk to Port-Orford-cedar from root disease would be completed prior to the start of site work.
- An offsite backfill source would be identified and tested for geotechnical and chemical properties to ensure a suitable material for restoration of the creek bank.
- The current access route to the creek banks would not require major improvements to support the removal activities.
- Temporary sandbags would be placed in the unnamed tributary on the upstream side of the work areas, and water would be temporarily diverted away from the work area.
- The source material on the creek banks of the unnamed tributary would be excavated and hauled to the onsite stockpile area. The excavated material would be placed inside the encapsulation unit and compacted by a loader and a bulldozer.
- Eighteen inches of soil would be removed from two shooting areas (one adjacent to the Open Pit and one at the Mill Site) for encapsulation in the Open Pit Area. Lead-contaminated waste within the Open Pit would be consolidated into the encapsulation unit as needed based on the final location of the unit.
- After all source materials are excavated (estimated 31,500 cubic yards), regrading would be conducted along the creek banks to restore them to as close to pre-mining conditions as possible. After regrading is completed, minimal amounts of riprap (approximately 10 tons) may be placed at the toe of the backfill for erosion control.
- The surface of the soil cap and restored areas would be covered with erosion control mats and hydroseeded, hand broadcast, and/or live-staked with native plants for slope stabilization as needed. Straw wattle would be installed along contours as an erosion control measure.

- The final location for the encapsulation unit would be determined in consultation with the Forest Service and specified in the removal action design. After all source materials are placed inside the encapsulation unit, a 2-foot-thick soil cap would be placed on top of the compacted source materials (specifications for the soil cap would be included in the final design).
- Imported soil would be weed free (approved by the Forest Service) to ensure that no non-native species are introduced into the Horse Mountain Botanical Area.
- After the removal action is complete, a focused monitoring and inspection program would be implemented during the first 12 months of the long-term maintenance program to ensure the planted vegetation is growing and meets design specifications and the erosion controls are functioning as intended.
- After the first year, periodic inspection and maintenance activities would be performed in subsequent years to maintain the integrity of the soil cap and the restored creek banks.

The estimated total capital cost for implementing this alternative is $1,480,000. The long-term total cost for implementing this alternative is $2,210,000, with a present value cost of $2,020,000. This cost represents an order-of-magnitude estimate, in accordance with the U.S. Environmental Protection Agency's guidance for conducting EE/CAs, with an intended accuracy of +50 to -30 percent.

Section 1. Introduction

Engineering/Remediation Resources Group, Inc. (ERRG) has prepared this Engineering Evaluation/Cost Analysis (EE/CA) Report for the U.S. Department of Agriculture (USDA) Forest Service Region 5 (Forest Service) for the Horse Mountain Mine and Mill Site in the Six Rivers National Forest located in Humboldt County, California. This work was conducted under the Regional A/E Indefinite Quantity Contract for Environmental Site Response Activities (AG-91S8-C-11-0001, Activity II, Task 2: EE/CA Support).

In 2007, the Forest Service performed a preliminary assessment/site inspection (PA/SI) at the site. Based on the results of the PA/SI (Weston Solutions, Inc. [Weston, 2007]), the Forest Service recommended that further action should be taken at the site to address and reduce site risks from (1) elevated metals in mine waste material throughout the site, (2) tailings that encroach into an unnamed ephemeral tributary, and (3) potential exposure of site visitors to asbestos. This EE/CA was prepared as part of the non-time-critical removal action (NTCRA) process under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The following subsections discuss the regulatory framework for the site, the purpose of the EE/CA, and the organization of this report.

1.1. REGULATORY FRAMEWORK

Authority for responding to releases from a hazardous waste site is addressed in Section 104 of CERCLA. Executive Order 12580 delegates the authority for removal actions to USDA. The Forest Service, under the delegation of USDA's authority, is the lead federal agency for environmental investigation and cleanup of the site and as such oversees all project activities. Other federal, state, or local agency representatives may be consulted at the discretion of the Forest Service. The Forest Service will ensure that all removal action activities comply with CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and Division 20, Chapter 6.8, of the State of California Health and Safety Code.

The U.S. Environmental Protection Agency (EPA) has classified removal actions into three types: emergency, time-critical, and non-time critical. The classification is based on the type of situation, the urgency to take action, the threat of release or potential release, and the period of time in which the action must be initiated (EPA, 1993). The removal action at the Horse Mountain Mine and Mill Site will be non-time-critical because a 6-month period is available before a removal action is taken at the site and the

threat to human health and/or ecological receptors is not immediate. Section 300.415(b)(4)(i) of the NCP requires that an EE/CA is prepared for all NTCRAs to evaluate removal alternatives for the site.

1.2. PURPOSE

The purpose of the EE/CA is to develop and analyze removal action alternatives in accordance with CERCLA and to recommend a removal action alternative that is protective of human health and the environment and compliant with federal and state applicable or relevant and appropriate requirements (ARARs). In accordance with EPA guidance, the EE/CA is completed to (1) meet the environmental review requirements for removal actions; (2) satisfy administrative record requirements for documentation of removal action selection; and (3) identify the objectives of a removal action and analyze the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives (EPA 1993).

1.3. REPORT ORGANIZATION

Following Section 1, this EE/CA is organized as follows:

- Section 2, Site Characterization – summarizes the site description and background, describes the physical characteristics of the site, and summarizes the source, nature, and extent of contamination based on previous investigations at the site.
- Section 3, Streamlined Risk Evaluation – discusses the selection and screening of chemicals of potential concern (COPCs), summarizes the site conceptual exposure model (SCEM), and summarizes the results of screening evaluation of site risks to human health and the environment.
- Section 4, Identification of Removal Action Goals and Objectives – identifies the removal action goals and removal action objectives (RAOs) that, if met, will result in the protection of human health and the environment, pursuant to CERCLA criteria.
- Section 5, Applicable or Relevant and Appropriate Requirements – lists and details chemical-specific, location-specific, and action-specific ARARs that aid in establishing cleanup criteria for the site.
- Section 6, Identification and Analysis of Removal Action Alternatives – describes the identification of removal action alternatives and analyzes each alternative for effectiveness, implementability, and cost.
- Section 7, Comparative Analysis of and Recommended Removal Action Alternatives – provides a comparative analysis of the four removal action alternatives and analyzes each for effectiveness, implementability, and cost to select a recommended removal action alternative for the site.
- Section 8, References – lists the reports, literature, and guidance documents used to prepare this EE/CA.

Figures and tables are provided following Section 8. In addition, the following supplemental information has been appended to the EE/CA:

- Appendix A. Photographic Log
- Appendix B. Analytical Data
- Appendix C. Technical Memorandum Regarding Preliminary Evaluation of Risk from Inhalation of Asbestos
- Appendix D. Detailed Cost Estimate

Section 2. Site Characterization

This section describes the Horse Mountain Mine and Mill Site and its historical use. It also summarizes the source, nature, and extent of contamination at the site based on the results of previous environmental investigations. This section provides the basis for understanding the COPCs and media of potential concern at the site.

2.1. SITE DESCRIPTION AND BACKGROUND

The Horse Mountain Mine and Mill Site is an inactive copper mine located in Sections 33 and 34 of Township 6 North, Range 4 East, within the Six Rivers National Forest, approximately 7 miles southwest of Willow Creek, in Humboldt County, California (Figure 1). The site is currently accessed via a paved road (Titlow Hill Road). Direct access to the site is via an improved gravel road located behind a locked gate. The site is easily accessible by two-wheel drive vehicle. The site includes roads, adits, and mine waste piles located along the banks of an unnamed ephemeral tributary that discharges into Horse Mountain Creek. The mine features consist of an Open Pit area, with an associated waste rock pile and two recreational shooting areas; the Adit/Pond Area with two primary adits, which have been secured with bat closures, two settling ponds, and a waste rock pile; and the Mill Site, with several concrete foundations for former operations and residence buildings, one waste rock pile, two small tailings piles, and a recreational shooting area. Horse Mountain Creek, a tributary to Willow Creek, runs northwest to southeast downslope and north of the site. A number of sensitive environments exist at and downstream from the site, including spawning habitat for anadromous fish. Mine waste has been observed to be in direct contact with flowing surface water at an unnamed tributary at the site (Weston 2007).

Figure 2 shows the site features, and photographs of site features are presented in Appendix A.

2.1.1. Operational History

Copper was discovered on Horse Mountain in the late 1800s or early 1900s. By 1908, several claims had been located at the site and surrounding property (TLI Solutions, 2009). The Horse Mountain Copper Company operated at the site from approximately 1909 until 1929 (TLI Solutions, 2009). According to the *Humboldt Historian*, the Horse Mountain Copper Company constructed several buildings at the site, including a stamp mill, concentration plant, blacksmith shop, cookhouse, powder magazine, and several cabins (TLI Solutions, 2009). Ore (rock containing valuable minerals) and concentrates were moved primarily by train to Humboldt Bay, and then shipped to Tacoma, Washington, for smelting (production of metal). Ores from the site are described in historical accounts as being high in gold and tungsten (Weston, 2007).

By 1916, reportedly 28 men were working at the Horse Mountain Mine (TLI Solutions, 2009). However, on the last load of ore shipped to Tacoma, Washington, in 1916, the treasurer accompanied the load and was never seen again. This reportedly "broke" the Horse Mountain Copper Company, and the mine was closed for a time at the end of 1916. Mining activities resumed eventually and continued until 1929 (TLI Solutions, 2009).

In 1958, a joint venture between Palo Verdis Mining Company and the Emperor Copper Company constructed mining plant facilities at the site, which included a copper mill, shop building, two residences, a laboratory building, a cookhouse, and a bunkhouse. Mining activities involved extracting copper and other minerals by electrolysis. Some limited open-pit mining also occurred during this period. The company, however, apparently went bankrupt within a few years (TLI Solutions, 2009). Although there were several claim holders between the 1960s and 1988, no significant mining operation occurred at the site after about 1959 (TLI Solutions, 2009).

2.1.2. Potentially Responsible Party Search, 2009

TLI Solutions conducted a Potentially Responsible Party (PRP) search in 2009. The intent of the search was to identify any parties who may bear some financial responsibility for site investigation and cleanup. The PRP search consisted of research into the various companies and individuals who held mining claims over the years and who conducted mining operations at the site. The PRP Report concluded that PRPs may exist and recommended that further research be performed to determine whether they are viable (TLI Solutions, 2009).

2.1.3. Current and Future Site Use

The site is currently closed to the public under a safety closure order issued by the Forest Service on June 19, 2012, because of the potential health hazards identified during the 2007 PA/SI (Forest Service, 2012). Prior to closure, the site was open to the public and regularly used as a recreational area. The site is easy to access year-round, and the gravel road at the site supports two-wheel drive traffic. The primary activities conducted at the site were hiking, rock climbing, mountain biking, all-terrain vehicle (ATV) riding, target shooting, and snow play during the winter. Areas at the Open Pit, directly adjacent to the Open Pit, and the Mill Site have been regularly used for target shooting (Figure 2). The site is a well-known and popular snow-play area. Humboldt County encourages its use in the winter through regular press releases informing the public that snow play on private land is illegal and snow-seekers should use public lands instead (Humboldt County, 2006 and 2012). The site is also popular year-round with recreational users, some of whom have expressed interest in developing a more formal trails system in the area (Forest Service, 2013d).

The site is located on a portion of the 1,100-acre Horse Mountain Botanical Area, which is a designated Special Interest Area within the Six Rivers National Forest, with land management requirements to ensure

the ongoing health of the ecosystem (Forest Service, 1995). Unique plant communities associated with serpentinite bedrock have been identified in the area. The botanical area is representative of the coastal serpentinite Jeffery pine (*Pinus jeffreyi*), western white pine (*Pinus monticola*), and Port-Orford-cedar (*Chamaecyparis lawsoniana*) communities (Forest Service, 1998 and 2013b).

The population of Port-Orford-cedar in the area contains unique genetic material and is distinctive from other coastal populations (Forest Service, 1998). In addition, the Port-Orford-cedar population in this area is uninfected by the Port-Orford-cedar root disease, caused by a fungus (*Phytophthora lateralis*) that attacks the trees roots, eventually killing them (Forest Service, 1997). The root rot disease is spread by spores in saturated soil and surface water and is easily tracked on muddy vehicle tires.

Current use of the site is restricted during the wet season to protect uninfected Port-Orford-cedars at the site. Protective measures include access restrictions during the rainy season and water use restrictions near the uninfected trees (Forest Service, 1995).

Future use of the site is anticipated to be primarily recreational, similar to the current use (prior to the closure).

2.1.4. Surrounding Land Use and Populations

The site is located in unincorporated Humboldt County within the Six Rivers National Forest (Figure 1). Humboldt County is located on the far north coast of California, bound on the north by Del Norte County; on the east by Siskiyou and Trinity counties; on the south by Mendocino County; and on the west by the Pacific Ocean. Humboldt County encompasses 2.3 million acres, 80 percent of which is forestlands, protected redwoods, and recreation areas (Humboldt County, 2013).

The nearest populated area is the community of Willow Creek. Willow Creek is located approximately 7 miles northeast of the site (Figure 1). Willow Creek is an unincorporated town, located on the border of Humboldt and Trinity counties. Willow Creek's population was 1,710 in 2010 (U.S. Census Bureau, 2010).

The Six Rivers National Forest stretches southward from the Oregon border for about 140 miles and encompasses 957,590 acres of national forest. The forest headquarters are located in Eureka, California, and the local ranger district office is located in Willow Creek. The watersheds of the Six Rivers National Forest are known for rafting, kayaking, and fishing. In addition to river recreation, popular activities in the Six Rivers National Forest include camping, hiking, backpacking, picnicking, and ATV use (Forest Service, 2013b).

2.2. PHYSICAL CHARACTERISTICS

2.2.1. Geology and Soil

The Horse Mountain Mine and Mill Site is located at the western boundary of the Klamath Mountains geomorphic province, where it meets the Cost Ranges Geomorphic province (Norris and Webb, 1990; Harden, 1998). The Klamath Mountains province is composed of accreted oceanic terrains divided by roughly north-to-south-trending faults that become younger to the west. The westernmost of the terrains is separated from the Coast Ranges geomorphic province to the west by the South Fork Mountain Fault. The geologic basement in the region primarily consists of metamorphosed Mesozoic sedimentary and volcanic rocks, including ophiolite suites underlain by older ultramafic rocks of Mesozoic and Paleozoic age (U.S. Geological Survey, 1966). The Cost Ranges province consists of Franciscan sequences of fine-grained pelagic sediments and mafic to ultramafic materials thought to be of Mesozoic age (Harden, 1998; California Geological Survey, 1977). The units are cut by the Coastal Range Fault, which is part of a series of generally north-to-south-trending thrust faults (California Geological Survey, 1977). Serpentinized ultramafic rocks occur east of the Coastal Range Fault and are commonly overprinted by Late Mesozoic to Tertiary plutonic and volcanic rocks (Weston, 2007). Chrysotile asbestos is a common mineral form of the serpentine minerals that comprise the serpentinite basement rocks present at the site (The American Geological Institute, 1984; Weston 2007). The site is in an area that the Forest Service has identified as likely to contain naturally occurring asbestos based on the rock types present (Forest Service, 2008).

Soil in the vicinity is in the Hungry Series, which is often found on mountainsides with 37 to 70 percent slopes and is well-drained soil formed from serpentinite (USDA National Resources Conservation Service [NRCS], 1998). The Hungry Series soil extends from 40 to 60 inches below ground surface and is moderately acidic throughout (USDA NRCS, 1998). The soil profile consists of very cobbly clay loam in the first 0 to 53 inches and unweathered serpentinite bedrock from 53 to 57 inches (USDA NRCS, 1998). The A horizon is a loam consisting of 25 to 32 percent clay and 15 to 50 percent gravel; the B horizon is a silty clay loam with 28 to 35 percent clay, 20 to 45 percent gravel, and 15 to 50 percent cobbles; and the C horizon is 15 to 35 percent gravel, 10 to 30 percent cobbles, and 5 to 15 percent stones (USDA NRCS, 1998).

2.2.2. Hydrology and Hydrogeology

The site is located within the Willow Creek Hydrologic subarea (unit 106.12) within the Trinity River Hydrologic unit (North Coast Regional Water Quality Control Board [NCRWQCB] 2011). Waters within the Willow Creek subarea have been designated for the following existing beneficial uses (NCRWQCB, 2011):

- Municipal and domestic supply
- Agricultural supply
- Industrial service supply
- Groundwater recharge
- Freshwater replenishment
- Navigation
- Hydropower generation
- Recreation (water contact and non-water contact)
- Commercial and sport fishing
- Cold freshwater habitat
- Wildlife (including rare, threatened, or endangered species) habitat
- Migration of aquatic organisms
- Spawning, reproduction, and/or early development of aquatic organisms

An unnamed tributary runs through the site and joins Horse Mountain Creek northeast of the site (Figure 2). Horse Mountain Creek is a tributary to Willow Creek, which runs northwest to southeast, north of the site. Willow Creek is the sole water source for the town of Willow Creek, which is located approximately 14 miles downstream of the site. Six wells in Willow Creek (near the confluence of Willow Creek and the Trinity River) pump up to 1.9 million gallons of water per day, with an average consumption during peak times of 1.6 million gallons per day (Winzler & Kelly Consulting Engineers, 2007). While these wells have been classified as groundwater wells in the past, they are currently classified as surface water intakes because they depend on surface water from Willow Creek to be productive (Willow Creek Community Services District, 2013).

Water flows regularly from one of the two adits at the site, but was observed to be dry during a site visit in September 2012. Water drains from this adit and flows through two settling ponds before flowing into the adjacent drainage, connecting to the unnamed tributary. No vegetation has been observed in the ponds; however, tadpoles were observed in the ponds during the EE/CA fieldwork in 2012.

The site is located in the North Coast Hydrologic Region, which covers approximately 12.46 million acres. Sixty-three groundwater basins covering more than 1 million acres have been identified in the region. Most of the groundwater extracted in the region is classified as surface water underflow rather than groundwater because it is intimately connected with and dependent on surface water infiltration. The primary impediment to useful groundwater basins in the mountainous inland areas of the region (e.g., the Horse Mountain area) is a lack of alluvial aquifer storage capacity (California Department of Water Resources [DWR], 2003). Most of the wells in Humboldt County that draw true groundwater find it to be

poor in quantity and quality, with insufficient production rates and high levels of iron and manganese (Winzler & Kelly Consulting Engineers, 2007).

The DWR Northern Regional Office has records of three domestic supply groundwater wells within a 4-mile radius of the site, located in Sections 19 and 30 of Township 6 North, Range 4 East (DWR, 2013). Groundwater is likely intimately connected to surface water, as evidenced by numerous springs observed during the field investigation as part of the PA/SI (Weston, 2007).

2.2.3. Environmental Setting

The Horse Mountain Mine and Mill Site is located approximately 22 miles east of the Pacific Ocean coastline, within the Klamath Mountains, at an average elevation of 4,400 feet above mean sea level. This section briefly describes the climate, ecology, and nearby sensitive environments of the Horse Mountain Mine and Mill Site.

The nearest weather station is located approximately 7 miles from the site in the town of Willow Creek. The Willow Creek station records a temperate climate, with average high temperature variations of approximately 40°F throughout the year. The average annual temperature is 71.8°F. Total average annual precipitation is about 50.86 inches (Western Regional Climate Center, 2012). Snowfall is not typical at Willow Creek, but is more common at the Horse Mountain Mine and Mill Site, which is known regionally as a snow-play area.

Sensitive environments within a 4-mile radius of the Horse Mountain Mine and Mill Site were identified during the 2011 and 2012 sampling events for this EE/CA and include habitat known to be used by the Northern Spotted Owl (*Strix occidentalis caurina*), a federally listed threatened species. The site also provides habitat for Bald Eagles (*Haliaeetus leucocephalus*), which are protected under the Bald and Golden Eagle Act, and is within the range of the Pacific Fisher (*Martes pennanti [pacific]*), which is federally listed as a candidate for threatened or endangered status (California Department of Fish and Game [CDFG], 2013; National Oceanographic and Atmospheric Administration [NOAA], 2013a). Anadromous fish populations have been documented downstream of the site, in the upper reaches of Willow Creek (Forest Service, 2001). Tables 1 and 2 list sensitive species (including threatened and candidate species) in the vicinity of the Horse Mountain Mine and Mill Site.

The site has been identified as part of the Horse Mountain Botanical Area, as discussed in Section 2.1.3, which exhibits unique plant communities associated with serpentinite bedrock representative of the coastal serpentinite Jeffery pine, western white pine, and Port-Orford-cedar communities (Forest Service, 1998 and 2013b). The Port-Orford-cedar population in the area is genetically unique and is considered at risk for contamination by root disease, which could have harmful effects to the trees and the ecosystem they help to sustain (Forest Service, 1998). The Port-Orford-cedar is highly prized for its beauty and utility as lumber stock (Forest Service, 2013c). Current use of the site is restricted during the wet season

to protect uninfected Port-Orford-cedars. Protective measures include access restrictions during the rainy season and water use restrictions near the uninfected trees (Forest Service, 1995). Tables 1 and 2 list other sensitive species (including threatened and candidate species) in the vicinity of the Horse Mountain Mine and Mill Site, including those species identified as characteristic of the Horse Mountain Botanical Area (Forest Service, 2013b).

2.2.4. Cultural Resources

No known cultural resources are present at the site; however, the site was identified as being located within the ancestral lands of the Hoopa Valley Tribe. While no cultural resources have been identified at the site, the Hoopa Valley Tribe has indicated an ongoing interest in the site and any removal activities conducted there (Hoopa Valley Tribal Council, 2011).

2.3. SOURCE, NATURE, AND EXTENT OF CONTAMINATION

This section summarizes the source, nature, and extent of contamination based on analytical data associated with the previous investigations and 2011 and 2012 sampling events conducted as part of this EE/CA at the Horse Mountain Mine and Mill Site. Waste rock and tailings related to mining activities have been identified in three primary areas of the site: the Open Pit Area, the Adit/Pond Area, and the Mill Site. Waste rock also has been observed to be in direct contact with the unnamed tributary to Horse Mountain Creek (see Figure 2). This section summarizes the results of the investigations and relevant data from the primary areas that are further evaluated in the streamlined risk evaluation (SRE). Figures 3 and 4 show the locations where samples were collected during the previous investigations at the Open Pit Area and Adit/Pond Area and the Mill Site, respectively.

2.3.1. Willow Creek Basin, Clean Water Act Funds, Surface Water Drainage Project

The Forest Service conducted a surface water diversion and watershed restoration project in the Willow Creek Basin in 1993 (Forest Service, 1993). This project included planting tree, brush, and grass species for erosion control on landslides; regrading abandoned mine roads and exposed waste piles at the site to prevent excess sediment from entering the surface water drainage, and collecting water and sediment samples at the site (Forest Service, 1993). During the planting and regrading project, 21 samples were collected from effluent water, settling pond water, and settling pond sediment during both high- and low-flow conditions to evaluate whether water flowing from a mine shaft into settling ponds or associated sediment contained heavy metals at concentrations that could affect water quality. The samples were sent to an offsite laboratory for analysis of heavy metals (arsenic, chromium, copper, lead, mercury, and zinc). Sample results indicated no detectable concentrations of heavy metals were present in surface water, except for chromium, which was detected at 0.041 milligram per liter in one outflow sample. Sediment samples exhibited elevated concentrations of chromium, copper, lead, and zinc. Concentrations ranged from 61 to 560 milligrams per kilogram (mg/kg) for chromium, 5.5 to 11 mg/kg for copper, 5.6 to 17 mg/kg for lead, and 11 to 110 mg/kg for zinc. Because outflow from the mine shaft and ponds was

minimal, the report concluded that sediments containing heavy metals were unlikely to migrate (Forest Service, 1993).

2.3.2. Preliminary Assessment/Site Inspection

In 2007, Weston conducted a PA/SI, which included collection of 22 waste rock and tailings, sediment, and surface water samples to evaluate metals and asbestos contamination at the site because prior grading operations may have caused comingling of waste at the site. In addition, one background soil sample was collected. Based on the type of sample and hazard concerns identified in the field, the samples were submitted to a qualified laboratory for analysis of Title 22 California Code of Regulations metals, total petroleum hydrocarbons, chrysotile asbestos, pH, and synthetic precipitation leaching potential (SPLP). Sample results were screened against several screening criteria identified in the PA/SI to evaluate whether site media posed a risk to human health or the environment. All samples contained detectable concentrations of heavy metals, but only metals concentrations in mine waste materials were considered elevated with respect to the screening criteria identified in the PA/SI. The highest metals concentrations were detected in fine-grained tailings material at the former Mill Site. All pH results were considered within normal ranges (Weston, 2007). The PA/SI also included a macroinvertebrate survey to evaluate stream health in Horse Mountain Creek.

The following subsections summarize the PA/SI results. Attachment 1 includes Tables 3-1 and 3-2 from the PA/SI that summarize the solid matrix and water sample results. Appendix B provides the complete laboratory analytical results for samples collected during the PA/SI. Data from the PA/SI were also incorporated into this EE/CA evaluation (see Section 3).

2.3.2.1. Metals Results

Waste Rock and Tailings. Twelve waste rock and tailing samples were collected during the PA/SI. Copper and lead were detected in waste rock and tailings samples at concentrations exceeding background levels and screening criteria. The copper exceedances ranged from less than 30 mg/kg to 16,500 mg/kg, and the lead exceedances ranged from less than 3 mg/kg to 4,480 mg/kg. The PA/SI concluded that mine tailings with significantly elevated concentrations of copper and lead had been released from the site and were encroaching into the unnamed tributary as a result of failing impoundments (Weston, 2007).

Sediment. Four sediment samples were collected in the unnamed tributary and Horse Mountain Creek, and results were compared with results for a background sample collected from Horse Mountain Creek above the confluence of the unnamed tributary and Horse Mountain Creek. The PA/SI concluded that metals in sediment were not elevated with respect to background, but chromium (52.3 mg/kg), copper (18.7 mg/kg), and nickel (15.9 mg/kg) exceeded ecological screening criteria (NOAA Screening Quick Reference Tables [SQuiRTs]) (Weston, 2007). Because these metals concentrations also exceeded

ecological criteria in the background samples, the PA/SI concluded that the concentrations detected downstream were within the regional norm for this area (Weston, 2007).

Surface Water. Three surface water samples were collected, and metals results were compared with results for two background samples and screening criteria. The PA/SI concluded that metals in surface water were not elevated with respect to background or screening criteria (Weston, 2007).

Leachability. Four waste rock and tailings samples were submitted for SPLP analysis by EPA Method 1312. Leachability by SPLP uses a mildly acidified deionized water extraction method, designed to simulate natural precipitation. This procedure is considered the most appropriate EPA-approved leachability test for determining concentrations of metals likely to leach from mine waste piles to groundwater or surface water because it mostly closely approximates conditions in a mine waste pile. All leachability samples had detectable concentrations of metals, but all concentrations were less than the screening criteria for ecological protection (NOAA SQuiRTs), indicating that metals were not very susceptible to leaching at concentrations of concern. Based on the low metals concentrations in surface water and low leachability, the PA/SI concluded that neither surface water nor groundwater at the site was considered a medium of potential concern (Weston, 2007).

Aquatic Invertebrates. Macroinvertebrate samples were collected from locations that represented the variety of habitat types present and targeted the richest habitats available (e.g., riffles, vegetated margins, layered cobble). Results of the aquatic invertebrate samples indicated that runoff from the mine had little impact on the biological integrity of Horse Mountain Creek (Weston, 2007).

2.3.2.2. Asbestos Results

During the PA/SI, three waste rock and tailings samples were submitted to the laboratory for analysis of chrysotile asbestos. One sample was collected from each of three primary areas of concern (i.e., the Open Pit Area, the Adit/Pond Area, and the Mill Site) (see Appendix C). Two of the three samples contained asbestos in excess of 1 percent. The sample from the Open Pit, which contained 31.3 percent chrysotile, and the sample from the Mill Site, which contained 5.4 percent chrysotile. The sample collected from the Adit/Pond Area contained less than 0.1 percent chrysotile (Weston, 2007).

National Emission Standards for Hazardous Air Pollutants defines “friable asbestos material” as any material containing more than 1 percent asbestos using the method specified in Title 40 Code of Federal Regulations (CFR), Part 763, Subpart E, Appendix E, Section (§) 1, “Polarized Light Microscopy” (PLM). Additionally, the California Air Resources Board’s Asbestos Airborne Toxics Control Measure (Title 17 California Code of Regulations [CCR] § 93106) indicates that “restricted material” includes ultramafic rock and any material that has been tested and found to have an asbestos content of 0.25 percent or greater, as measured by PLM).

The PA/SI concluded that risk may be posed to site visitors from chrysotile asbestos present in site soil and air when dust is generated (Weston, 2007).

2.3.3. 2011 and 2012 EE/CA Sampling Events

ERRG collected samples of waste rock and tailings, as well as activity-based air samples, to estimate volumes of waste and further delineate the nature and extent of contamination at the site in support of the EE/CA. The following subsections summarize the collection and results of the waste rock and tailings and activity-based samples.

2.3.3.1. Waste Rock and Tailings Samples

On August 30, 2011, ERRG visited the site to estimate the volume of waste rock and tailings material on site and collect additional samples. Based on visual observations, approximately 31,500 cubic yards of waste and tailings material was estimated to be present on site[1]. Most of the waste at the site consists of unprocessed waste rock with a small amount of tailings (approximately 20 cubic yards) in the Mill Site. The largest waste rock pile is located northeast of the settling ponds and closed adit at the Adit/Pond Area, along and north of the main road (Figure 2). The pile consists of approximately 20,000 cubic yards of waste rock in several merging piles that extend from the road down to the creek bed of the unnamed tributary to Horse Mountain Creek. The second largest pile is located at the Open Pit Area, north of the pit and across the road (Figure 2). The pile consists of approximately 8,000 cubic yards of waste rock. This pile extends downslope from the Open Pit, but is not in direct contact with any surface water drainage. A smaller pile of waste rock (450 cubic yards) is located at the Mill Site (Figure 2). Approximately 20 cubic yards of tailings were also identified at the Mill Site in three small piles (Figure 2). Additionally, three recreational shooting areas were identified in 2011: one in the Open Pit, one adjacent to the Open Pit, and one at the Mill Site (Figure 2). Appendix A1 provides photographs of the shooting areas. The volume of waste at the three shooting areas is estimated to be 1,290, 575, and 775 cubic yards, respectively. An estimated volume of 275 cubic yards of concrete mill foundations is present at the Mill Site.

ERRG collected two samples of the tailings materials, which were not sampled during the PA/SI. One tailings sample was collected from the riffled concrete area below the mill foundations (HM-TL-LOWER), and one tailings sample was collected from the black sand tailings on top of the lower mill foundations (HM-TL-BKSD). Figure 3 shows the locations where the tailings samples were collected, and Appendix A provides photographs of tailings areas. Samples were collected with disposable sampling equipment and placed in the appropriate pre-cleaned sample containers. Samples

[1] Note: A detailed land survey will be required to better quantify volumes of waste at the site. Preliminary volume estimates were made during the PA/SI and are significantly higher than those presented in this EE/CA. Volume estimates for this EE/CA were based on visual observation of distinct piles of source materials (waste rock or tailings) on site. The volume estimates in the PA/SI appear to be based on visual observations of disturbed areas multiplied by the average thickness of piles within each disturbed area. Because the site was regraded (Forest Service, 1993), it is possible that additional volumes of source materials are present on site, beyond those calculated for this EE/CA.

were placed in a cooler with ice for transport to TestAmerica Laboratory in Pleasanton, California, where they were analyzed for California Assessment Manual 17 metals. Sample results were generally consistent with results from the PA/SI, with concentrations of barium, chromium, cobalt, copper, lead, nickel, and vanadium exceeding background values. Antimony, which was detected in most of the PA/SI samples, was not detected at concentrations exceeding background, and arsenic, which was not detected in any of the PA/SI samples, was detected at concentrations exceeding background but less than screening criteria in both of the 2011 samples.

2.3.3.2. Activity-Based Air Sampling for Asbestos

Based on the conclusions of the PA/SI, collection of additional samples was necessary to evaluate the risk posed by airborne asbestos to site visitors. In September 2012, activity-based air samples were collected for analysis of asbestos. Currently, no available methods can reliably predict the concentration of asbestos in air based on concentrations in source materials (i.e., soil, waste material, or building materials). As noted by EPA (2008), collection of activity-based samples is the most appropriate method for estimating risk from asbestos at sites where asbestos has been detected in soil in excess of 1 percent. A complete summary of activity-based sampling and the risk evaluation is presented in the "Technical Memorandum Preliminary Evaluation of Risk from Inhalation of Asbestos at the Horse Mountain Mine and Mill Site, Six Rivers National Forest," which is provided as Appendix C to this EE/CA. Appendix A2 provides photographs taken during the activity-based sampling event, and Appendix B provides the complete analytical laboratory data for asbestos.

Activity-based air samples were collected to simulate potential airborne concentrations of asbestos during activities that are likely to occur at the Horse Mountain Mine Site. Activity-based air samples were collected and evaluated for asbestos in accordance with EPA's Standard Operating Procedure 2084 (EPA, 2007) and the EE/CA Work Plan (ERRG, 2012) for the following site-specific recreational scenarios:

- Mountain biking
- Hiking (modified jogger scenario)
- ATV riding
- Recreational shooting

Activity-based samples were collected from each of three areas at the site (Open Pit, Adit/Pond, and Mill Site) and a background area for each activity. Because recreational activities are often conducted in groups of two or more, where one person follows another, the follower may be exposed to dust generated by the leader. To simulate this, two field samplers, one leader and one follower, conducted each activity. Each sampler also collected two samples, one with the intake positioned to represent the breathing zone of an adult and the second with an intake positioned to represent a child's breathing zone. Samples were collected using personal air pumps, equipped with preloaded asbestos filter cassettes.

Ambient air samples were also collected upwind and downwind during activity-based samples to evaluate the ambient air quality each day that samples were collected.

Samples were collected during the driest part of the year, when dust is most likely to become airborne, to ensure that worst-case scenario was evaluated. Figures in Appendix C show the sampling routes and areas, as well as the ambient air monitoring locations. Soil across the site varied in grain size and level of compaction but was generally very consistent in composition. Soil consisted primarily of fragments of the green/gray serpentinite bedrock visible throughout site. Soil, waste, and road materials had a slightly greenish-gray appearance.

Activity-based and ambient air samples were shipped to an offsite California-certified laboratory for TEM analysis of asbestos to distinguish between asbestos fibers and non-asbestos fibers, performed in accordance with the International Organization for Standardization (ISO) Method 10312 (ISO, 1995).

In total, 75 samples were collected. Sixty-two of the 75 samples were found to contain measurable concentrations of asbestos. Asbestos fibers were detected in 43 of the 50 activity-based air samples, in 14 of the 16 background samples, and in 5 of the 9 ambient air samples. Chrysotile was the most commonly detected fiber type. Thirty-eight of the 62 samples that contained asbestos fibers contained 100 percent chrysotile. Twenty-four samples contained a mix of chrysotile and amphibole asbestos. The percentage of chrysotile in the samples ranged from 39.2 percent to 88.7 percent, with an average of 67.2 percent.

An SRE was completed for each exposure scenario (mountain biker, hiker, ATV rider, and recreational shooter) to evaluate the potential cancer risk to site visitors for various recreational activities that might occur on the site. Cancer risk is the estimated probability that a person will develop cancer from exposure to site contaminants and is generally expressed as an upper-bound probability. For example, a risk of 1 in 1,000,000 (1×10^{-6}), indicates that for every one million people, one additional cancer case may occur as a result of exposure to asbestos at the site. This EE/CA adopted a conservative approach and used the cancer risk of 1×10^{-6}, which meets the most conservative end of the risk management range established by EPA (1×10^{-4} to 1×10^{-6}).

The SRE determined that airborne asbestos concentrations detected in all three site areas (Open Pit Area, Adit/Pond Area, and the Mill Site), as well as at a nearby offsite background area, may pose unacceptable risk. The SRE calculated the following risks at the site:

- Mountain Biking: Asbestos in one sample exceeded the risk management range (at 2×10^{-4}) and was within the risk management range (between 3×10^{-5} and 1×10^{-4}) in 11 samples.
- Hiking: Asbestos in nine samples was within the risk management range (between 1×10^{-5} and 8×10^{-5}) and was less than the risk management range (less than 1×10^{-6}) in three samples.

- ATV Riding: Asbestos in eight samples exceeded the risk management range (between 2×10^{-4} and 5×10^{-4}) and was within the risk management range (between 8×10^{-5} and 1×10^{-4}) in four samples.
- Recreational Shooting: Asbestos in four samples was within the risk management range (between 2×10^{-5} and 7×10^{-5}) and was less than the risk management range (less than 1×10^{-6}) in four samples.

For the background sampling, the SRE calculated the following risks:

- Mountain Biking: Asbestos in two samples was within the risk management range (6×10^{-5} and 7×10^{-5}) and was less than the risk management range (less than 1×10^{-6}) in two samples.
- Hiking: Asbestos in four samples was within the risk management range (between 9×10^{-6} and 7×10^{-5}).
- ATV Riding: Asbestos in three samples exceeded the risk management range (between 2×10^{-4} and 4×10^{-4}), and was within the risk management range (7×10^{-5}) in one sample.
- Recreational Shooting: Asbestos in four samples was within the risk management range (between 2×10^{-5} and 4×10^{-5}).

The results of the asbestos evaluation indicate that, while some risk is associated with asbestos at the site, no distinguishable difference in risk exists between the three site areas and the background area. EPA guidance does not recommend cleanup to less than background, even if the background concentration exceeds a risk-based concentration (EPA, 2002). Therefore, a removal action to address asbestos at the site is not required. As a result, this EE/CA focuses on the evaluation of removal action alternatives to address metals in mine wastes.

Section 3. Streamlined Risk Evaluation

This section summarizes the SRE of potential risks to human health and the environment from exposure to metals at the Horse Mountain Mine and Mill Site. Potential risks were evaluated for exposure to waste rock and tailings (referred to collectively as "source materials"), sediment, and surface water. The SRE is typically used to qualitatively evaluate rather than quantify potential risks to justify a removal action and develop appropriate removal action alternatives to reduce risk. Accordingly, the potential risks to human and ecological receptors from exposure to metals were evaluated by comparing COPCs to appropriate benchmarks, as discussed below.

Potential risks to human health were evaluated based on recreational uses at the site and on consumption of water from Horse Mountain Creek. Ecological risk was evaluated based on metals toxicity effects on select sensitive species exposed to contaminated source materials, sediment, and water. A separate SRE for asbestos is presented in the "Technical Memorandum, Preliminary Evaluation of Risk from Inhalation of Asbestos at the Horse Mountain Mine and Mill Site, Six Rivers National Forest," which is provided as Appendix C to this EE/CA.

The following subsections describe the selection and screening of COPCs, the SCEM, and the results of the SRE.

3.1. SELECTION AND SCREENING OF CHEMICALS OF POTENTIAL CONCERN

All analytical data collected during the PA/SI and the 2011 sampling event were initially tabulated (Tables 3, 4, and 5). Following compilation of the data, all metals data were screened against site-specific background values to exclude metals that represent background. Background values were established for metals in soil, sediment, and surface water. Background samples were collected in August 2007 (Weston, 2007). One background soil sample, one background sediment sample, and two background surface water samples were collected. Figure 3 shows the background sample locations. Results of the background samples were used to establish background values for 17 metals in soil[2], sediment, and surface water (Tables 3, 4, and 5).

The 2007 and 2011 sample results were compared with the background values for each metal to identify whether a metal was present at concentrations consistent with background. Metals that exceeded the established background values in one or more samples for a given matrix were retained as COPCs and evaluated further in the SRE (see Section 3.3). Metals that did not exceed the background values in any

[2] Soil background values were compared with the metals results for source material samples.

sample or were not detected above laboratory reporting limits in any sample were removed from the SRE and not evaluated further.

The following subsections summarize the findings of the comparison of 2007 and 2011 sample results with background values for source materials, sediment, and surface water.

3.1.1. Source Materials

The results for sample HM-SS-1 were used to establish background values for source materials, as shown in Table 3. The background sample was collected near the intersection of Titlow Road and Forest Road 6N38 (Figure 3). Where metals were not detected, the sample detection limits were used to represent the concentration in the background sample. As shown in Table 3, the following metals were detected at concentrations exceeding the background values and were retained as COPCs for source materials (background values are provided in parentheses):

- Antimony (9.88 mg/kg)
- Arsenic (1.0 mg/kg)
- Barium (1.98 mg/kg)
- Cadmium (0.5 mg/kg)
- Chromium (556 mg/kg)
- Cobalt (72.8 mg/kg)
- Copper (4.07 mg/kg)
- Lead (0.5 mg/kg)
- Mercury (0.54 mg/kg)
- Nickel (1,560 mg/kg)
- Silver (0.5 mg/kg)
- Thallium (1.0 mg/kg)
- Vanadium (7.52 mg/kg)
- Zinc (11.4 mg/kg)

Antimony was detected in all 14 samples at concentrations exceeding background, ranging from 2.9 to 25.2 mg/kg. Arsenic was detected in two samples from the Mill Site at concentrations (6.6 and 7.0 mg/kg) exceeding background. Barium was detected in 12 samples at concentrations exceeding background, ranging from 3.07 to 18.1 mg/kg. Cadmium was detected in one sample from the Mill Site at a concentrations (1.33 mg/kg) exceeding background. Chromium was detected in all 14 samples at concentrations exceeding background, ranging from 602 to 1,180 mg/kg. Cobalt was detected in six samples from the Mill Site at concentrations exceeding background, ranging from 80.5 to 123 mg/kg. Copper was detected in all 14 samples at concentrations exceeding background, ranging from 5.26 to 16,500 mg/kg. Lead was detected in 11 samples at concentrations exceeding background, ranging from 1.4 to 4,480 mg/kg. Mercury was detected in one sample from the Adit/Pond Area at a concentration (0.90 mg/kg) exceeding background. Nickel was detected in four samples from the Mill Site at concentrations (ranging from 1,630 to 2,030 mg/kg) exceeding background. Silver was detected in five samples from the Mill Site and the Adit/Pond Area at concentrations (ranging from 0.725 to 2.36 mg/kg) exceeding background. Thallium was detected in one sample from the Mill Site at a concentration (1.20 mg/kg) exceeding background. Vanadium was detected in all 14 samples at concentrations exceeding background, ranging from 13.3 to 50.8 mg/kg. Zinc was detected in 13 samples at concentrations exceeding background, ranging from 14.5 to 398 mg/kg.

3.1.2. Sediment

The results for HM-SD-14 were used to establish background values for sediment, as shown in Table 4. The background sediment sample was collected upgradient from the confluence of the unnamed tributary and Horse Mountain Creek (Figure 3). Where metals were not detected, the sample detection limits were used to represent the concentration in the background sample. As shown in Table 4, the following metals were detected at concentrations exceeding the background values and were retained as COPCs for sediment (background values are provided in parentheses):

- Antimony (8.78 mg/kg)
- Barium (4.17 mg/kg)
- Chromium (577 mg/kg)
- Cobalt (45.7 mg/kg)
- Copper (41.4 mg/kg)
- Nickel (1,080 mg/kg)
- Vanadium (20.8 mg/kg)
- Zinc (9.48 mg/kg)

Antimony was detected in all four samples at concentrations exceeding background, ranging from 10.7 to 13.5 mg/kg. Barium was detected in three samples at concentrations exceeding background, at concentrations from 5.07 to 6.69 mg/kg. Chromium was detected in all four samples at concentrations exceeding background, ranging from 603 to 844 mg/kg. Cobalt was detected in three samples at concentrations exceeding background, ranging from 50.1 to 55.6 mg/kg. Copper was detected in three samples at concentrations exceeding background, ranging from 57.6 to 116 mg/kg. Nickel was detected in two samples at concentrations (1,140 and 1,210 mg/kg) exceeding background. Vanadium was detected in four samples at concentrations exceeding background, ranging from 23.8 to 41.4 mg/kg. Zinc was detected in four samples at concentrations exceeding background, ranging from 9.72 to 14.2 mg/kg.

3.1.3. Surface Water

The results for HM-SW-1 and HM-SW-2 were used to establish background values for surface water, as shown in Table 5. The background surface water samples were collected from a location above the confluence of the unnamed tributary and Horse Mountain Creek and from the unnamed tributary above the culvert, which diverts the unnamed tributary under the mine road (see Figure 3). To conduct the background screen, the results of the two samples were averaged to provide the background value. If one result was less than the reporting limit and one result was detected, one-half the reporting limit was used in the average. As shown in Table 5, the following metals were detected at concentrations exceeding the background values and were retained as COPCs for surface water (background values are provided in parentheses):

- Barium (10 micrograms per liter [µg/L])
- Chromium (10 µg/L)
- Nickel (22 µg/L)
- Zinc (22 µg/L)

Barium was detected at a concentration of 10 µg/L in the sample from the Adit Pond, which was equivalent to background (i.e., the detection limit). Chromium and nickel were detected at concentrations

(15 and 45 µg/L, respectively) exceeding background in the water sample from below the Mill Site. Zinc was detected at concentrations (29 and 32 µg/L, respectively) exceeding background in the water samples from the Adit Pond and below the Mill Site. No metals concentrations exceeded background in the downstream sample collected from Horse Mountain Creek.

3.2. SITE CONCEPTUAL EXPOSURE MODEL

The SCEM is a descriptive and graphical presentation of the physical, chemical, and biological relationships between sources of contaminants and potentially exposed populations. Figure 5 presents the SCEM for the Horse Mountain Mine and Mill Site. As shown on Figure 5, the primary source of metals contamination is mine waste from former mining operations at the site. The primary release mechanisms are mechanical and physical disturbance, which resulted in the creation of waste rock and tailings piles (i.e., source materials) at the site.

The transport mechanisms describe the physical mechanisms by which the source materials are transported to the potential exposure media. Potential transport mechanisms at the site include airborne dust, leaching and infiltration, erosion and runoff, and deposition of source materials. Potential exposure media at the site include particulates in air, surface and subsurface soil, groundwater, surface water, and sediment.

The potential routes of exposure to metals are from inhalation of particulates; ingestion and direct contact with surface and subsurface soil, surface water, and sediment; and ingestion of groundwater. The only complete and significant pathways at the site are to ecological receptors from ingestion of and direct contact with surface water and sediment. Surface water and sediment are complete pathways to ecological receptors that live in and along the banks of the creek, where waste rock containing elevated metals is in direct contact with the surface water pathway.

Other complete exposure pathways that are not considered significant include (1) inhalation of particulates by recreational visitors or onsite wildlife, and (2) ingestion of surface or subsurface soil by humans or wildlife. Inhalation of particulates is considered an insignificant exposure pathway because human and ecological receptors are not likely to disturb surface source materials at the site for long durations of time. Metals from onsite tailings and waste materials may become airborne during ATV riding, but exposure to the highest concentrations of metals (in the tailings materials within the mill foundations) is unlikely to occur, because the mill foundations are outside of the roads and trails used by ATV riders. Likewise, extended exposure to elevated airborne metals in dust generated from waste piles associated with the Open Pit and Adit/Pond Area is unlikely because ATV riders are likely to pass through these areas along roadways and not spend large quantities of time on the metals-impacted piles. Subsurface soil is considered an insignificant exposure pathway because site visitors and wildlife are unlikely to come in contact with subsurface soil and controls would be implemented to protect future construction workers during removal action work or other site work that would disturb the subsurface.

Surface water is used for drinking water approximately 10 miles downstream of the site in Willow Creek, but metals concentrations in surface water at the site are not elevated with respect to background, so this pathway is not considered complete. Additionally, the PA/SI concluded that metals from source materials are not likely to leach to surface water or groundwater (Weston, 2007). However, as noted in the PA/SI, waste piles containing elevated metals are in contact with surface water at the site and "continuous or prolonged exposure" to these waste materials could result in a future release to surface water. Therefore the surface water pathway has the potential to become a complete pathway in the future. Groundwater is considered an incomplete pathway because there are no groundwater targets (i.e., no one is drinking groundwater from the site) (Weston, 2007).

Based on the current and future land use at the site and observed uses of the site, the potential human receptors include recreational visitors (e.g., hikers, mountain bikers, rock climbers, recreational shooters, and ATV riders), future construction workers, and Forest Service personnel. Based on observed and assumed species to be present at the site (Section 2.2.3), the potential ecological receptors include fish, fish eggs from spawning fish, and fish fry; birds; and mammals.

3.3. RISK SCREENING

Potential risks to human and ecological receptors from metals were evaluated by comparing the COPC concentrations in each medium (source material, sediment, and surface water) with appropriate screening criteria developed for protection of human health and the environment. COPC results that exceeded screening criteria were retained as chemicals of concern (COCs). Tables 3, 4, and 5 present the results of the screening evaluation for source materials, sediment, and surface water, respectively. Figures 3 and 4 show the distribution of COCs at the Open Pit and Adit/Pond Areas and the Mill Site, respectively.

The following subsections summarize the results of the SRE for human and ecological receptors and present the conclusions of the SRE.

3.3.1. SRE Results

The following subsections summarize the methods used to screen risk to human and ecological receptors and the results of the SRE.

3.3.1.1. Human Receptors

Recreational visitors were identified as the primary human receptors that might be exposed to metals contamination at the site. As a result, the Bureau of Land Management's (BLM) soil, sediment, and surface water risk management criteria (RMC) for protection of campers and ATV riders were selected as the screening criteria that are most appropriate to screen risk to humans from exposure to metals in source materials, sediment, and surface water at the site (BLM, 2004).

In the absence of BLM criteria, the following benchmarks were used to screen risk to human health: (1) EPA's regional screening levels for soil under an industrial worker exposure scenario, and (2) EPA's regional screening levels for tap water (EPA, 2012) and maximum contaminant levels for drinking water (EPA, 2009). The secondary criteria are considered conservative given the remoteness of the site and the fact that workers will not be regularly present on site.

Tables 3, 4, and 5 present the screening criteria used in the SRE and the results of the SRE evaluation for COPCs in source materials, sediment, and surface water.

Source Material Results. Concentrations of copper in source materials exceeded screening criteria for the camper exposure scenario. Lead concentrations at the Open Pit Area exceeded the screening criterion for the camper and ATV driver exposure scenarios (Table 3). Copper concentrations were elevated in all source material samples collected at the site, with concentrations in 3 of the 14 samples exceeding human health criterion for the camper scenario (5,000 mg/kg). The maximum concentration of copper was 16,500 milligrams per kilogram (mg/kg) in sample HM-TL-10, collected from the Mill Site (Figure 4).

Lead concentrations were elevated in samples collected from source materials at all three areas of the site, with concentrations in one sample exceeding the human health criteria for the camper and ATV driver exposure scenarios (1,000 mg/kg). The maximum concentration of lead was 4,480 mg/kg in sample HM-SS-13, collected from the Open Pit Area. The Open Pit has been identified as an area used for recreational shooting, which may be a source of lead contamination not directly associated with the former mining activities at the site.

No other human health screening criteria were exceeded for source materials.

Based on the range of detected concentrations, the magnitude of detected concentrations in relation to background concentrations, and the magnitude of the exceedances in relation to the screening criteria, both copper and lead are considered the primary risk drivers with a moderate risk of adverse effects to humans exposed to source materials at the Open Pit Area and Mill Site.

Sediment Results. None of the COPCs were detected in sediment at concentrations exceeding screening-level benchmarks for protection of human health (Table 4). Therefore, humans who come in contact with sediment in Horse Mountain Creek or the unnamed tributary are not likely to be adversely affected by metals at these concentrations.

Surface Water Results. None of the COPCs were detected in surface water at concentrations exceeding screening-level benchmarks for protection of human health (Table 5). Therefore, humans who come in contact with surface water in Horse Mountain Creek or the unnamed tributary are not likely to be adversely affected by metals at these concentrations.

3.3.1.2. Ecological Receptors

Potential risks to ecological receptors from exposure to metals in source materials, sediment, and surface water were evaluated by comparing the detected concentrations of each COPC with appropriate screening criteria developed for protection of ecological receptors. The following ecological benchmarks were evaluated and used for the risk evaluation, as appropriate:

- **Soil Ecological Benchmarks.** EPA's ecological soil screening levels (Eco-SSLs) (EPA, 2013) and BLM wildlife and livestock criteria for soil (BLM, 2004) were evaluated and selected as screening criteria. Of these, the Eco-SSLs are generally more conservative (i.e., lower) and were deemed most appropriate for comparison with source materials data. Eco-SSLs are available for various receptor types (such as mammalian and avian carnivores). To protect the most sensitive species that may be present at the site, the lowest of the available Eco-SSLs was used in the risk screen. In the absence of an Eco-SSL for mercury, the BLM ecological criteria were evaluated and the criterion for deer mouse was selected because it represents a likely prey animal for avian carnivores that have been identified as at risk receptors present at the site.
- **Sediment Ecological Benchmarks.** The following ecological criteria were evaluated: threshold effect concentrations and probable effects concentrations (PECs) developed to evaluate sediment quality in freshwater ecosystems (NOAA, 2013b) and threshold effects levels and probable effects levels developed specifically for invertebrates living in freshwater sediment (Florida Department of Environmental Protection, 1994). Of these ecological criteria, the PECs were deemed most appropriate and protective for comparison of sediment data.
- **Surface Water Ecological Benchmarks.** Ecological criteria were based on EPA's National Ambient Water Quality Criteria for Freshwater Aquatic Life Protection, which were developed to protect fish and lower trophic levels in fresh waters (NOAA, 2013a). EPA criteria are available for both acute and chronic exposure. The criteria based on chronic exposure are lower and therefore more conservative, thus they were used in the risk screen. In the absence of chronic criteria, the acute criteria were used.

Tables 3, 4, and 5 present the results of the SRE for COPCs in source materials, sediment, and surface water. The results for each medium are summarized below.

Source Material Results. Concentrations of antimony, cadmium, chromium, copper, lead, nickel, vanadium, and zinc in soil and waste materials exceeded ecological benchmarks (Table 3). Based on the range of detected concentrations, the magnitude of detected concentrations in relation to background concentrations, and the magnitude of the exceedances in relation to the screening criteria, antimony, chromium, copper, lead, nickel, and zinc are considered the primary risk drivers with a high risk of adverse effects to wildlife receptors exposed to source materials.

Sediment Results. Concentrations of chromium and nickel in sediment exceeded screening-level benchmarks for protection of invertebrates in sediment (Table 4). The maximum chromium concentration (844 mg/kg) was approximately 8 times higher than the PEC, and the maximum nickel concentration

(1,210 mg/kg) was approximately 25 times higher than the PEC. The elevated concentrations of chromium and nickel indicate a moderate to high risk of adverse effects to ecological receptors exposed to sediment in Horse Mountain Creek and the unnamed tributary. However, the maximum detected concentrations of chromium and nickel are less than twice the background concentrations. In the absence of a thorough background metals study, these concentrations are considered within the range of background levels and are not considered to be elevated with respect to background.

Surface Water Results. None of the COPCs were detected at concentrations exceeding their respective ecological screening criteria (Table 5). Therefore, ecological receptors (including fish, birds, and mammals) exposed to surface water in Horse Mountain Creek or the unnamed tributary are not likely to be adversely affected by metals at these concentrations.

3.3.2. SRE Conclusions

The SRE concluded that source material at the Horse Mountain Mine and Mill Site may pose unacceptable risk to human and ecological receptors. Humans that come into contact with source material may be exposed to copper and lead at concentrations that may pose an unacceptable risk to human health. Ecological receptors may also be exposed to antimony, cadmium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc in source materials at concentrations that may pose unacceptable risk.

Sediment is not expected to pose unacceptable risk to human recreational users of the unnamed tributary. Concentrations of chromium and nickel in sediment were greater than screening criteria protective of invertebrates; however, the concentrations detected were within a reasonable range of background concentrations and are not considered elevated, thus no risk is posed to ecological receptors from sediment.

Metals in surface water at the site were less than applicable criteria for the protection of human health and ecological receptors. As a result, surface water is not expected to have a negative impact on human recreational users or on spawning or downstream fish populations.

In evaluating risk, the BLM suggests interpreting exceedances of the RMC as follows (BLM, 2004):

- Less than the criteria: low risk
- 1 to 10 times higher than the criteria: moderate risk
- 10 to 100 times higher than the criteria: high risk
- Greater than 100 times the criteria: extremely high risk

Based on the above criteria, the risk from COCs to humans is moderate, whereas the risk to ecological receptors ranges from low to high. The high ecological risks are from source materials at the site. It is anticipated that by removing the source materials, both human and ecological risks will be reduced to acceptable levels.

Section 4. Removal Action Goals and Objectives

The purpose of this EE/CA is to develop and analyze removal action alternatives in accordance with CERCLA and to recommend a removal action alternative that is protective of human health and the environment and compliant with ARARs. The removal action alternative will be selected in an Action Memorandum, which is to be prepared by the lead federal agency (i.e., the Forest Service). The following sections describe the removal action goals and RAOs for the Horse Mountain Mine and Mill Site, as well as the removal action schedule. The goals for the site may be altered following the submittal of this EE/CA, if additional information becomes available from stakeholders or other interested parties that requires reevaluation of the RAOs. As such, the final removal action goal and RAOs will reflect these alterations and refinements, if any, and will be defined in the Action Memorandum.

4.1. REMOVAL ACTION GOALS AND OBJECTIVES

The overall goal of the removal action is to minimize risks associated with metals contamination at the site that are posed to human health and the environment. The following preliminary RAOs were developed to reduce the risks to humans and wildlife at the site:

- Reduce exposure of humans and wildlife to metals in source materials (i.e., waste rock and tailings) to acceptable levels.
- Reduce the release of metals eroding from source materials (i.e., waste rock and tailings).

These objectives will be achieved through attainment of the ARAR-based and risk-based goals. The NTCRA in this EE/CA considers a cleanup and containment level protective of human health and the environment based on the nonresidential and recreational use of the site, as well as the habitat use of ecological receptors. The NTCRA will focus on the removal of COCs at concentrations exceeding cleanup levels developed for the protection of humans and wildlife. These COCs are present in source materials at all three areas of the site: Open Pit Area, Adit/Pond Area, and Mill Site.

4.2. CLEANUP LEVELS

Based on the results of the SRE, COCs in source materials pose a potential risk to both humans and wildlife. Regulatory standards and risk-based screening levels, along with site use considerations, were used to develop the cleanup levels. The cleanup levels for the site are based on reducing risks to acceptable levels for humans and wildlife that could potentially use the site.

While regulatory standards and risk-based screening levels must be considered in the development of cleanup levels, EPA guidance and policy do not recommend that cleanup levels be established at concentrations less than background, even if the background concentration exceeds an ARAR or risk-based screening level (EPA, 2002). Where a regulatory standard or risk-based screening level is greater than the background value, the standard or risk-based screening level is used as the cleanup level.

Preliminary cleanup levels were developed using a combination of regional background values, site background values, and EPA Eco-SSLs and are presented in Table 6. However, further evaluation of regional and site background values should be incorporated into the final cleanup levels. Eco-SSLs were selected as the preliminary cleanup levels for metals in soil because they are the most conservative of all screening levels evaluated. By achieving the RAOs, the potential risks to human health and the environment will be reduced or eliminated. Figure 6 shows the approximate boundaries of the areas where tailings and mine waste will be removed.

4.3. REMOVAL SCHEDULE

The Forest Service has determined that a NTCRA is appropriate for the Horse Mountain Mine and Mill Site. The NTCRA could begin within 6 months following approval of this EE/CA. Based on past experience with implementation of removal action alternatives similar to those proposed in this EE/CA and the volume of material to be removed, it is estimated that any removal action undertaken can be completed within 5 to 9 months, depending on which alternative is selected.

Section 5. Applicable or Relevant and Appropriate Requirements

Section 300.415(i) of the NCP provides that removal action must attain ARARs to the extent practical, considering the exigencies of the situation. In general terms, ARARs are environmental regulations, standards, criteria, or limitations promulgated under federal or more stringent state laws. An ARAR may be either applicable, or relevant and appropriate, but not both.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the law or regulation directly address the circumstances at the site. An applicable federal requirement is considered an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup criteria, or limitations promulgated under federal or state law that, while not applicable to the specific situation at a CERCLA site, address problems or situations similar to the circumstances of the proposed removal action and are well suited to the conditions of the site (EPA, 1988). A requirement must be determined to be both relevant and appropriate to be considered an ARAR.

To qualify as a state ARAR under CERCLA and the NCP, a state requirement must be a promulgated law, substantive, consistently applied, and more stringent than a federal requirement. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or non-environmental, including permit requirements, are not considered to be ARARs. Non-promulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. However, such requirements may be useful and are “to be considered” (TBC) for guiding decisions regarding cleanup levels or methodologies when regulatory standards are not available.

The EPA has developed three categories of ARARs to assist in the identification of site requirements. The three categories of ARARs are (1) chemical-specific, (2) location-specific, (3) and action-specific. EPA guidance recognizes that some requirements do not fall neatly into this classification; however, the following definitions provide a general guideline for each of these categories:

- Chemical-Specific ARARs are usually health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numeric values (i.e., cleanup levels). These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment.
- Location-Specific ARARs are restrictions placed on the concentrations of hazardous substances or the conduct of activities solely because they occur in special locations. Location-specific ARARs relate to the geographical or physical position of the site (e.g., presence of wetlands, sensitive species, flood plains, etc.).
- Action-Specific ARARs are activity-based requirements or limitations on actions taken with respect to hazardous substances.

As the lead federal agency, the Forest Service has primary responsibility for identifying federal ARARs. EPA (1988) guidance recommends that the lead federal agency consult with the state when identifying state ARARs. In a letter dated November 1, 2011, the Forest Service requested ARARs from the following agencies:

- EPA Region 9
- California Department of Toxic Substances Control
- NCRWQCB
- NOAA's National Marine Fisheries Service
- CDFG
- California State Historic Preservation Office
- Humboldt County Department of Health and Human Services, Environmental Division
- California Air Resources Board
- U.S. Army Corps of Engineers
- California Department of Transportation

In addition, letters were sent to the Hoopa Tribe and the Blue Lake Tribe. Only one response was received. The Hoopa Tribe responded on November 8, 2011, and indicated their support of a cleanup action at the site and interest in continued involvement in the process (Hoopa Valley Tribal Council, 2011).

The federal and state ARARs that are presented in this document represent a preliminary analysis of ARARs. In addition, standards and statutes developed and compiled from the Six Rivers Land and Resource Management Plan (Forest Service, 1995) were included as TBC in the ARARs evaluation. Other federal and state advisories, criteria, or guidance may, as appropriate, be considered in formulating the removal action. The following sections summarize the potential chemical- location- and action-specific ARARs identified for this project. Tables 7 through 11 summarize the ARARs for this project.

5.1. POTENTIAL CHEMICAL-SPECIFIC ARARS

The Forest Service has identified the substantive provisions of the following potential federal and state chemical-specific ARARs for the site:

5.1.1. Surface Water

The **Clean Water Act** regulates discharges to waters of the United States and requires water quality control plans for the waters of the State, including development of water quality standards. These standards are set forth in the **California Toxics Rule (CTR), 40 CFR §131.38,** as well as the **Water Quality Control Plan for the North Coast Region (Basin Plan)** (NCRWQCB, 2011), and include chemical concentration limits, as well taste and odor thresholds and other requirements (e.g., pH, color, suspended and settleable material, sediment, turbidity, dissolved oxygen, bacteriological quality, and temperature). The CTR and Basin Plan standards were identified as ARARs for the site because they apply for areas where waste materials from the site are in contact with surface water; any discharges to site surface waters must comply with this ARAR. Additionally, State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board chemical-specific ARARs (presented in Table 8) to protect waters of the state were identified as potential ARARs. Any discharges to site surface waters must also comply with these ARARs.

Nonpromulgated ambient water quality criteria developed by EPA and used to establish water quality standards are TBCs for this site. These criteria are nonenforceable guidance that are generally considered potentially relevant and appropriate for surface water considered a potential drinking water source in the absence of promulgated Maximum Contaminant Levels (MCLs). Also, because the surface water's designated beneficial use includes protection of aquatic life, the ambient water quality criteria may be the most appropriate values where the criteria are more stringent than the MCLs.

Federal and State Safe Drinking Water Act, 40 CFR Part 141, MCLs are considered potential ARARs, because they are relevant and appropriate. Surface water downstream from the site is currently being used as a drinking water source; however, no contaminant levels have been detected at concentrations exceeding applicable MCLs at the site. MCLs are relevant and appropriate for any action at the site to ensure protection of downstream surface water intakes.

5.1.2. Air

There are no potential chemical-specific air ARARs for inhalation of vapors from the site. Inhalation of airborne particulates during construction is evaluated under action-specific ARARs (see Section 5.3).

5.1.3. Soil

The BLM has developed **Risk Management Criteria for Metals at BLM Mining Sites** that, while not promulgated, are generally considered relevant and appropriate for evaluating and cleaning up abandoned

mine sites and are TBCs for this site. These risk-based values are not site-specific, but evaluate exposure to human and ecological receptors typical of mine sites on public lands (BLM, 2004). These values are appropriate as site screening tools and as initial cleanup goals, if applicable.

EPA's Regional Screening Levels (RSLs) are nonpromulgated soil screening criteria developed as tools for evaluating and cleaning up contaminated sites. The RSLs for soil under an industrial scenario are TBCs for this site. These values are not site-specific, but are generally considered potentially relevant and appropriate for soil or waste material that humans may be exposed to.

Under the Resource Conservation and Recovery Act (RCRA), the **Bevill Amendment, 40 CFR §261.4(b)(7)**, excluding mining ores and minerals from hazardous waste classification, is an ARAR. This amendment applies to waste piles at the site that are from extraction of minerals, thus they do not warrant regulation as hazardous waste and are not subject to RCRA Subtitle C regulation. This exemption is also recognized by the State of California (Health and Safety Code § 25143.1[b][1&2]), so waste from the site would not receive a hazardous classification under RCRA or California RCRA.

EPA Office of Solid Waste and Emergency Response (Directive No. 9285.7) provides nonpromulgated guidance for conducting ecological risk assessments and presents Eco-SSLs for protection of wildlife (EPA, 2013). The Eco-SSLs are generic (i.e., they are calculated without site-specific information) and are appropriate for use as site screening tools and initial cleanup goals if applicable. These criteria are TBCs for this site.

5.2. POTENTIAL LOCATION-SPECIFIC ARARS

The **Endangered Species Act, 16 United States Code (USC) § 1536(a),(h)(1)(B)**, applies for all habitat upon which threatened or endangered species depend. The act states that federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. This act is an ARAR for the site because habitat supporting threatened or endangered species, including the Northern Spotted Owl and the recently de-listed Bald Eagle, is present at the site and directly downstream of the site. Additionally, habitat that supports the Pacific Fisher, a candidate for endangered listing, is present downstream of the site. Prior to any removal action, a biological evaluation may be required to determine the potential for adverse effects or harm to any listed species or habitat that supports listed species (including areas along and downstream of the unnamed tributary and Horse Mountain Creek within the site).

The **Migratory Bird Treaty Act, 16 USC § 703**, prohibits the pursuit, hunting, capturing, killing, or the attempt to take, capture, or kill any migratory bird. This act is a potential ARAR because it is relevant and appropriate to the project site. Although no migratory birds have specifically been identified at the site, migratory birds may use the site seasonally. If migratory bird species are identified at or near the site in the future, compliance with this act would be required.

Executive Order No. 11988, Floodplain Management, 40 CFR § 6.302(b), requires that work within floodplains or flood-prone areas be conducted to minimize potential harm and restore and preserve natural and beneficial floodplains. This order is identified as an ARAR because it applies for removal of waste piles from the unnamed tributary, which requires work within the floodplain. Floodplain management actions must be incorporated into the design and removal action work plan, as appropriate.

The **Magnuson-Stevens Fishery Conservation and Management Act, 16 USC §§ 1801–1882**, requires conservation and management of specific fisheries. This act is a potential ARAR because it is relevant and appropriate for site surface waters; managed fisheries are present downstream of the site. The potential effects of removal actions on downstream managed fisheries must be evaluated in the design and removal action work plan, as appropriate.

No historic properties included on or eligible for inclusion on the National Register have been identified at the site; therefore, the **National Historic Preservation Act the National Historic Preservation Act of 1966** (16 USC § 470–470x-6, 36 CFR 800, and 40 CFR § 6.301[b]) is not an ARAR. However, the **Archaeological and Historic Preservation Act, 16 USC § 469–469(c)(1) and 40 CFR § 6.301(c),** which establishes procedures to protect historical and archaeological data, is a potential ARAR because it is relevant and appropriate for the site. Although no historical or archaeological resources have been formally identified at the site to date, an evaluation of the potential for these resources to be present on site is needed prior to conducting the removal action. If archaeological resources are identified, compliance with this act will be required. Likewise, the **Archaeological Resources Protection Act, Public Law No. 96-95, 16 USC § 470aa–470mm**, which prohibits unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources on public lands is a potential ARAR because it is relevant and appropriate. Compliance with this act will be required if archaeological resources are documented at the site in the future.

Executive Order No. 11990, Protection of Wetlands, protects against adverse impacts associated with the destruction or loss of wetlands and against new construction in wetlands if a practicable alternative exists. This requirement is a potential ARAR because it is relevant and appropriate to the portion of the site near one of the former adits, where the impoundment ponds are located. This area is likely a former wetland area, although it has been modified by construction of the tailings impoundments. To the extent practicable, this area should be restored during the removal action. The removal action design and work plan must ensure that this area remains a low-lying area where water may pond naturally and support wetland conditions.

The **Special Interest Areas (SIA) Classification, 36 CFR 294.1**, provides provisions for establishing SIAs, managed principally for recreation, and substantially maintained in their natural condition. This requirement is an ARAR, because it applies to the 1,100-acre Horse Mountain Botanical Area, a designated SIA. Botanical Areas are "classified for the protection of unique botanical values, for

educational purposes, and for recreational use compatible with these values" (Forest Service, 1998). The primary value of the Horse Mountain Botanical Area is "Jeffery Pine Woodland." Species designated as "of significance" include the Port-Orford-cedar and 13 plant associations within the Jeffrey pine, western white pine, Port-Orford-cedar, Douglas-fir, white fir, knobcone pine, and grassland series, including five rare plant species (Forest Service, 1998). The SIA Management Strategy notes that the upper reaches of Horse Mountain Creek are critical to protection of Port-Orford-Cedar populations and also states that mine sites within the Horse Mountain Botanical Area "may be causing resource damage and have altered the scenic quality of the area" (Forest Service, 1998). Any action taken in the area must comply with the Forest Service's SIA Management Strategy for the Horse Mountain Botanical Area. In addition, Appendix K of the **Six Rivers National Forest Land and Resource Management Plan** (Forest Service, 1995) requires that plans be drawn up and implemented to protect existing populations of Port-Orford-cedar from exposure to root disease. While this document is not promulgated, it is a TBC for the site, because a unique population of uninfected Port-Orford-cedars is present at the site. Appropriate evaluation of Port-Orford-cedars and protective measures for uninfected trees, including disease control strategies listed in Appendix K, must incorporated into any action at the site.

5.3. POTENTIAL ACTION-SPECIFIC ARARS

The **Clean Water Act 33 USC § 1251 et seq.**, which establishes the basic structure for regulating discharges of pollutants to the waters of the United States and regulating quality standards for surface waters, is applicable and is an ARAR for the site. Limitations, standards and other permit conditions (applicable to State National Pollutant Discharge Elimination Systems [NPDES] programs) established in **40 CFR § 122.44(k)(2) and (4)** also apply and are ARARs. California's SWRCB has developed general permit requirements pursuant to these federal regulations. Substantive requirements of the SWRCB's **NPDES General Permit for Storm Water Discharges Associated with Construction Activity (General Permit), Water Quality Order 99-08-DWQ** for all stormwater discharges associated with construction activity are TBCs in complying with the requirement to apply best management practices (BMPs) for stormwater discharges promulgated at 40 CFR § 122.44(k)(2) and (4). For all activities where construction will disturb more than 1 acre, a Stormwater Pollution Prevention Plan specifying BMPs to prevent construction pollutants from contacting storm water must be developed and implemented, along with measures to eliminate non-stormwater discharges and requirements for BMP inspections. In addition, the **North Coast Regional Water Quality Control Board Draft Basin Plan Amendment**, which prohibits the discharge of excess sediment during earth-disturbing activities, is a TBC for the site for any earthmoving activities. The plan amendment states: "The discharge or threatened discharge of excess sediment from human caused activities to waters of the state is prohibited." Excess sediment is defined as "soil, rock, or sediment discharged to waters of the state in an amount that could be deleterious to beneficial uses or cause a nuisance." The removal action design and work plan should consider this proposed amendment and ensure that removal activities are planned in such a way that discharges of excess sediment do not occur.

The **Fish and Wildlife Coordination Act, 16 USC § 661**, requires federal agencies to take into consideration the effect that water diversion or other modifications to natural streams have on fish and wildlife and take action to prevent loss or damage to those resources. This act is an ARAR because it applies to all activities at the site that include diverting the unnamed tributary and restoring the creek bed. Consideration for the conservation, maintenance, and management of wildlife resources and habitat within the unnamed tributary, including the development and improvement of such wildlife resources, is required.

The **Native American Graves Protection and Repatriation Act, 25 USC § 3001 et seq. 43 CFR Part 10**, requires that Native American graves not be disturbed and that, if discovered, excavation and ground disturbance will be stopped. This requirement is a potential ARAR because it is relevant and appropriate for all ground-disturbing activities at the site. Although no Native American graves have been identified at the site, if graves or cultural items are discovered, excavation work must stop and affiliated tribes must be notified and consulted prior to continuing work.

The **American Indian Religious Freedom Act, 42 USC § 1996 et seq.**, protects and preserves the traditional religious rights and cultural practices of Native Americans, including access of sacred sites, freedom to worship through ceremonial and traditional rights, and use and possession of objects considered sacred. This requirement is a potential ARAR because it is relevant and appropriate for activities at the site and requires that site activities have no negative impact on the free practice of religion by Native American groups. If sacred sites are identified within construction areas prior to or during site work, work will be stopped and appropriate Native American groups will be notified prior to continuing the project.

The **California Mining Waste Regulations Pursuant to California Water Code § 13172, 27 CCR §§ 22470–22510**, addresses the management of mining waste, including specific requirements on siting, construction, monitoring, and closure and post-closure maintenance of existing and new units. This is a potential ARAR for the site because it is relevant and appropriate to construction of onsite encapsulation unit(s).

The **California Air Resources Board, Asbestos Airborne Toxic Control Measure for Construction, CCR Title 17, § 93105**, sets forth requirements for health protection during earthmoving activities that disturb ultramafic or serpentinite soils. These requirements are a potential ARAR for the site because they are applicable to construction activities that will disturb serpentinite soil known to contain asbestos. Monitoring, personal protective equipment (PPE), and dust-suppression measures (e.g., wetting soil) will be required during any activity that disturbs serpentinite soil at the site. In addition, **North Coast Unified Air Quality Management District's Rule 104** prohibits discharge of hazardous materials to air via fugitive dust. This nonpromulgated rule is a TBC for any earthmoving activity to ensure that appropriate

monitoring, PPE, and dust-suppression measures are in place to protect worker health and safety during construction.

EPA has developed a **Framework for Investigating Asbestos-Contaminated Superfund Sites,** which is nonpromulgated guidance for the investigation and characterization of sites with potential asbestos contamination and is a TBC for the site (EPA, 2008). If removal activities require samples for analysis of airborne asbestos, standard operating procedures outlined in this guidance document would be appropriate.

Section 6. Identification and Analysis of Removal Action Alternatives

To identify removal action alternatives for the Horse Mountain Mine and Mill Site, potential response actions were selected based on the RAOs, ARARs, and EPA guidance (EPA, 1993). The technologies and process options specific to the response actions are screened, and the retained technologies and process options of each general response action are assembled into removal action alternatives. The selected removal action alternatives are then evaluated with respect to their effectiveness, implementability, and cost.

Based on the guidelines presented in the "Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA" (EPA, 1993), only the most qualified technologies that apply to the media or source of contamination should be discussed in the EE/CA. Limiting the number of alternatives to those that have been selected in the past at similar sites or for similar contaminants provides an immediate focus to the discussion and selection of alternatives.

The remainder of this section summarizes the general response actions, presents the evaluation criteria, identifies the removal action alternatives, and summarizes the analysis of alternatives with respect to the evaluation criteria.

6.1. GENERAL RESPONSE ACTIONS

Three general response actions were considered for this EE/CA:

1. No Action
2. Engineering Controls
3. Offsite Disposal of Source Materials

The no-action category is retained throughout the evaluation process as required by the NCP to provide a baseline for comparison with other alternatives. Table 12 summarizes the screening of technologies and processes associated with the general response actions. The removal action alternatives were identified based on the general response actions and are discussed in Section 6.3.

6.2. EVALUATION CRITERIA

The analysis of removal action alternatives is qualitative in nature and is based on the following three evaluation criteria, as recommended by EPA (1993): effectiveness, implementability, and relative cost. The following subsections summarize each criterion.

6.2.1. Effectiveness

Alternatives are evaluated for effectiveness based on the following criteria:

- Overall Protection of Human Health and the Environment: This criterion assesses the ability of the alternative to be protective of human health and the environment under present and future land use conditions.
- Compliance with ARARs: Identifies whether or not implementation of the alternative would comply with all chemical-specific, action-specific, and location-specific ARARs.
- Long-Term Effectiveness: This criterion addresses the magnitude of residual risk remaining at the conclusion of removal activities. It addresses the adequacy and reliability of controls established by a removal action alternative to maintain reliable protection of human health and the environment over time.
- Reduction of Toxicity, Mobility, or Volume through Treatment: Identifies whether or not implementation of the alternative would reduce contaminant toxicity (e.g., reduction of metals), mobility, or actual volume of the hazardous substances.
- Short-Term Effectiveness: This criterion addresses the effects of an alternative during the construction and implementation phase until the RAOs are met. This criterion includes the time with which the remedy achieves protectiveness and the potential to create adverse impacts on human health and the environment during construction and implementation of the remedy.

6.2.2. Implementability

Alternatives are evaluated for implementability based on the following criteria:

- Technical Feasibility: Evaluates constructability and operational considerations, as well as demonstrated performance/useful life.
- Administrative Feasibility: Evaluates those activities such as statutory limits, permitting requirements, easements and rights of way, and impacts on adjoining property
- Availability of Services and Materials: Evaluates the availability of qualified contractors to provide the necessary services, materials, and equipment (with the preferred technologies being those that are commercially developed and readily available, or innovative technologies that have been field-tested with documented results). Also evaluates the availability of disposal facilities that are licensed to accept solid and liquid waste classified as hazardous and nonhazardous.

- State Acceptance: The concurrence of the State of California with the proposed alternatives.
- Community Acceptance: The acceptance of the proposed alternatives by the community.

6.2.3. Cost

Technologies were evaluated based on qualitative costs. Alternatives with lower costs were preferred if the effectiveness and implementability criteria were judged to be similar. The cost estimates were prepared to aid in the evaluation of alternatives using information that is currently available. These costs are order-of-magnitude estimates with an intended accuracy of +50 to -30 percent (EPA, 2000). These costs are not construction bid costs, nor are they final project costs. Final project costs will depend on actual labor and material costs, actual engineering design costs, actual site conditions (including the actual quantities of mine waste excavated and the amount of material that may be classified as hazardous waste), competitive market conditions, the final project scope, the final project schedule, and other variables. As a result, the final project costs will vary from these estimates.

6.3. ANALYSIS OF REMOVAL ACTION ALTERNATIVES

The following removal action alternatives were identified for the Horse Mountain Mine and Mill Site based on the general response actions and screening discussed in Section 6.1:

1. Alternative 1: No Action
2. Alternative 2A: Excavation and Onsite Encapsulation of Source Materials (one encapsulation unit, soil cover)
3. Alternative 2B: Excavation and Onsite Encapsulation of Source Materials (one encapsulation unit, asphalt cover)
4. Alternative 3A: Excavation and Onsite Encapsulation of Source Materials (two encapsulation units, soil cover)
5. Alternative 3B: Excavation and Onsite Encapsulation of Source Materials (two encapsulation units, asphalt)
6. Alternative 4: Excavation and Offsite Disposal of Source Materials

Each alternative was analyzed below for its capability to reduce the risks detailed in Section 3. Specifically, the alternatives are analyzed for effectiveness, implementability, and cost. Following the individual analysis of alternatives presented below, each alternative will be compared against the others to select the recommended removal action (Section 7).

6.3.1. Alternative 1: No Action

Under Alternative 1, no action would be taken at the site under current or future land use scenarios. As such, the human and ecological risks relating to the site would remain unchanged. The no-action

alternative is evaluated as required by the NCP to provide a baseline for comparison with other alternatives.

6.3.1.1. Effectiveness

Alternative 1 does not provide short-term or long-term protection of public health. This alternative would not comply with ARARs. The time required to achieve the RAO is indefinite, and risks to current and future receptors would remain indefinitely. The toxicity, mobility, and volume of contamination at the site would not be reduced through treatment and potential receptor exposure pathways would remain for current and future receptors.

6.3.1.2. Implementability

Alternative 1 would be readily technically and administratively feasible, and no services or materials are needed for implementation.

6.3.1.3. Cost

The total estimated cost for Alternative is $0 (see Appendix D). No costs, are associated with this alternative.

6.3.2. Alternative 2A: Excavation and Onsite Encapsulation of Source Materials (One Encapsulation Unit, Soil Cover)

Under Alternative 2A, all source materials (i.e., mine waste rock and tailings) and the mill building foundations would be removed and transported to an onsite encapsulation unit at the Open Pit Area to minimize future exposure of humans or wildlife to site contamination. In total, approximately 31,500 cubic yards of source materials would be encapsulated on site. Lead-contaminated material from shooting areas would also be encapsulated with the waste removed from other areas. Waste material at settlement ponds would be excavated and regraded so surface water drains directly into the unnamed tributary.

Drainage from the adit would be diverted (contained and redirected to connect with the unnamed tributary), while source materials are excavated and the area backfilled. Drainage water upstream of the excavation area would be dammed using sandbags, diverted around the excavation, and released at a location downstream of the active excavation area. A tracked excavator would be used to remove source materials in the Open Pit Area, Adit/Pond Area, and Mill Site, and haul trucks would be used to transport excavated materials to the onsite encapsulation unit at the Open Pit Area. Heavy earthmoving equipment would be used to stockpile waste material, spread and compact the material to the intended depth and footprint, and eventually install a soil cap.

The removed and stockpiled source materials would be capped with at least 2 feet of clean offsite fill material and graded for drainage[3]. The cap is anticipated to cover an area of approximately 64,000 square feet. The top foot of clean fill would require regular monitoring and maintenance to ensure that lead from shooting activities does not impact the site. A brightly colored demarcation fabric layer would be placed at a depth of 12 inches below ground surface within the clean cover material. The brightly colored fabric will alert future workers when performing inspections or maintenance so they do not expose the waste material or compromise the integrity of the soil cap.

Backfill that meets the gradation and cleanup level requirements would be transported from a local source. Regrading would be conducted to restore, to the degree practicable, the natural pre-mining contours and morphology of the site where material is removed. The cap would be compacted and covered with biodegradable erosion control mats. Certified weed-free straw wattle would be installed along contours as a BMP to control erosion. Riprap (rock) may be placed at the bottom of the restored creek bank (in the unnamed tributary) to prevent scouring of the newly placed bank materials and to better simulate the natural substrate of the creek bed. It is assumed that an area of up to 5 acres would be seeded either by hydroseeding or by hand-broadcasting methods using a native plant seed mix developed in consultation with the Forest Service's biologists.

Figure 6 shows the location of the encapsulation unit, and the approximate areas where source materials will be removed.

This alternative would require a detailed topographic survey to establish precise waste volumes, an engineering study to establish the site requirements for the encapsulation unit, and geotechnical and chemical testing of the offsite source for backfill to ensure appropriate requirements are met. Following the pre-design studies, a final engineering design would be conducted prior to the start of work. In addition to the engineering design, a report evaluating strategies for reducing the risk to Port-Orford-cedar from root disease would be completed prior to the start of site work. Figure 6 shows the habitat of uninfected Port-Orford-cedar at the site.

Appropriate engineering and institutional controls would be required during construction to protect workers. These controls would address the presence of asbestos in source materials and the high likelihood for asbestos to become airborne during construction work. These controls may include wetting of roads and source material throughout construction, using PPE (e.g., disposable coveralls and air-purifying respirators), and air monitoring (both personal air monitoring and site air monitoring).

Future institutional controls, such as placing signs around the encapsulation unit to reduce the potential for erosion of the cap by site visitors and ensure that permanent vegetation is established, may be required in the engineering design.

[3] Offsite fill material was deemed more appropriate for use than onsite fill because naturally occurring asbestos is likely present in locally derived rock (see Appendix C).

6.3.2.1. Effectiveness

Onsite encapsulation of excavated materials would provide overall protection of human health and the environment. Source materials would be encapsulated such that exposure of humans or wildlife to waste would be reduced. This alternative would comply with all chemical-, location-and action-specific ARARs. However, detailed planning, as described below, is needed to comply with location-specific and action-specific ARARs. The toxicity, mobility, or volume of contamination at site would not be reduced through treatment. Risks to current and future receptors would be reduced by removal to levels considered protective of human health and the environment. This alternative is considered to be reliable based on accepted industry standards for similar projects.

Long-term risks to current and future receptors related to contaminated source materials would be minimized by encapsulating the source materials and covering them with a 2-foot-thick soil cap. The finished surface would be smooth, compacted, and free from irregular surface changes. The final grades would provide positive drainage of surface water to minimize erosion. Additionally, this alternative would permanently remove source materials from the unnamed tributary that flows to Horse Mountain Creek, thereby eliminating the potential for future releases to the creek. Long-term periodic inspection and maintenance of the soil cap would be required to ensure the long-term integrity of the cap (i.e., to ensure that it is not compromised by natural erosion or human activities) to provide long-term protection of human health and the environment. Periodic monitoring of metals concentrations in sediments at and downstream of the creek would be conducted to evaluate long-term health of the creek. Removal activities associated with this alternative are not anticipated to have severe or lasting harmful effects on the sensitive species at and downstream of the site. While a soil cover is considered a durable and long-term solution, waste materials would remain on site, and the risk of a breach of the soil cover would still exist.

Measures would be implemented to minimize the short-term impacts to the unnamed tributary and to Horse Mountain Creek. Construction activities would be implemented using BMPs such that short-term impacts to humans (including site construction workers) and the environment would be minimized. Worker protection would be provided during implementation of the remedy through strict adherence to a site-specific safety and health plan. An exclusion zone, a decontamination zone, and a staging zone would be established at the site to reduce potential migration of contamination to adjacent areas. The exclusion zone would encompass the contaminated areas, and any persons entering this zone would be required to don the appropriate PPE. The decontamination zone would be used to remove contamination from equipment and PPE before it is cleared to leave the exclusion zone. The staging zone is where decontaminated equipment would be stored when not in use in the exclusion zone.

To meet action-specific ARARs, dust generation would be suppressed by applying water and performing real-time dust monitoring. Airborne metals and asbestos are potential hazards to human health at the site and strict controls must be implemented to ensure worker safety during construction. Real-time dust

monitoring instrumentation would detect particulate concentrations greater than applicable dust action levels. Respiratory protection would be required for all site workers; however, use of water trucks is generally highly effective and may eliminate the need to use respiratory protection. Air monitoring to establish daily airborne metals and asbestos levels for various work types may be conducted to establish the effectiveness of dust suppression techniques and down grade the level of respiratory protection if warranted. Airborne dust monitoring would be completed using portable hand-held dust monitors to verify and document daily dust-suppression efforts. These dust control methods would also reduce the migration of dust onto adjacent properties. Additionally, special care would be taken to minimize impacts to the Port-Orford-cedar population to maintain its short- and long-term health. Water for use in dust suppression and compaction would be drawn from site surface water that is uncontaminated by Port-Orford-cedar root rot. All vehicles and equipment entering the Port-Orford-cedar habitat areas would be decontaminated prior to entering and exiting the site.

6.3.2.2. Implementability

This alternative is considered technically feasible and services and materials are readily available in the vicinity of the site. Excavation and onsite encapsulation is a proven method for removing the exposure pathway to site receptors and reducing the risk posed to human health and the environment. This alternative could be implemented in a way that would minimize environmental impacts and could be performed within one construction season. The site access road is in good condition and would likely not require major reconditioning to allow heavy equipment and import materials to be transported to the site. The services, equipment, and materials to implement this alternative are common and readily available in the site vicinity, either from the community of Willow Creek or from the Eureka area. This alternative is also considered to be administratively feasible. Permits, access agreements and easements are either not required or would be granted by the Forest Service, which is both the property owner and is acting as the lead agency in this removal action. A Remedial Design and a Work Plan, with an associated sampling and analysis plan and site-specific health and safety plan, would be required prior to the start of work. No impacts to adjacent property are anticipated for this action.

Because mine waste is exempt from waste disposal criteria provided in RCRA while it is located within a mining area [Title 40 CFR §261.4(b)(7)], onsite encapsulation of source materials would not be regulated under hazardous waste disposal and landfill regulations. However, other federal or state requirements regarding appropriate siting, construction, and long-term inspection and maintenance may apply [e.g., regulations for corrective action management units (CAMUs) at Title 40 CFR Part 264, Subpart S, and Part 264.552(c) and mining waste regulations pursuant to California Water Code § 13172 at Title 27 CCR § 22470–22510).

Because the source material would be consolidated and encapsulated on site, the Forest Service would ensure that substantive requirements for siting and construction of mine waste impoundments to ensure protection of groundwater and surface water downgradient from the encapsulation unit were met (Title 27

CCR § 22510). Available leachability test data (Weston, 2007) indicated that the encapsulated source material should not pose a future threat to water quality if the integrity of the cap is maintained.

The Open Pit would be a suitable location for a single onsite encapsulation unit, with enough capacity to accept the estimated volume of source material (31,500 cubic yards) from the Open Pit Area, Adit/Pond Area, and the Mill Site (Figure 6). This location is relatively open with gradual slopes (1:2 and 1:3), virtually no vegetation, and covers an area of approximately 2.75 acres in the most northwestern portion of the site. Portions of the Open Pit have been excavated or graded below the original ground level and cut into an existing hill while the mine was in operation, leaving a suitable hollow that could be filled in.

This alternative would likely be acceptable to the state and the community because it would meet the RAOs, would improve the site for recreational use, and would require minimal long-term maintenance.

The final decision regarding the location for the encapsulation unit would be made during the design phase of the project; however, it is unlikely that another location within the site would be as suitable for consolidating all removed materials.

6.3.2.3. Cost

The estimated total capital cost for implementing this alternative is $1,480,000. The long-term total cost for implementing this alternative is $2,210,000, with a present value cost of $2,020,000. Appendix D provides the detailed cost estimate. The following major assumptions have been identified for Alternative 2A:

- Site personnel would consist of a site superintendent, a site quality control (QC) engineer who would also provide health and safety oversight, and up to three operators, five truck drivers, and one laborer.
- A large tracked excavator would be used to excavate source materials. Four off-road haul trucks would be used to transport source material. Other heavy equipment would include a skidsteer, bulldozer, compactor, backhoe, and a water truck.
- The estimated duration of field activities would be 73 days.
- Estimated quantity of material to be excavated and transported is 30,210 cubic yards (1,290 cubic yards of lead impacted materials will be consolidated in place at the Open Pit).
- Estimated amount of cover material is 7,600 tons for the 2-foot soil cover (assuming 1.6 tons = 1 compacted cubic yard).
- Source material would be approximately 20 feet thick over 64,000 square feet.
- A 2-foot-thick soil cover would be installed at the Open Pit
- A local quarry would be used to obtain clean cover material and could deliver at least 500 cubic yards per day.

- Imported soil would be weed free (approved by the Forest Service) to ensure that no non-native species are introduced into the Horse Mountain Botanical Area.
- No major road improvements would need to be performed.
- No liner would be necessary for encapsulation.
- Two weeks would be needed for preparation of implementation plans (Work Plan, Health and Safety Plan, etc.) and of the removal action completion report.
- Up to 5.5 acres would be hydroseeded or hand broadcast with native seed.

6.3.3. Alternative 2B: Excavation and Onsite Encapsulation of Source Materials (One Encapsulation Unit, Asphalt Cover)

Under Alternative 2B, all source materials (i.e., mine waste rock and tailings) and building foundations at the Mill Site would be removed and transported to an encapsulation unit at the Open Pit, as described under Alternative 2A. Instead of a clean soil cover being installed, source materials would be encapsulated with an asphalt cover.

6.3.3.1. Effectiveness

The effectiveness of Alternative 2B is the same as for Alternative 2A (see Section 6.3.2.1). Asphalt is an effective durable cover for waste encapsulation.

6.3.3.2. Implementability

Alternative 2B has the same technical and administrative implementability as Alternative 2A (see Section 6.3.2.2). As under Alternative 2A, long-term inspection and maintenance would need to be performed. This alternative would likely be acceptable to the state and the community because it would meet the RAOs, would improve the site for recreational use, and would require minimal long-term maintenance. The final decision regarding the location of the encapsulation unit would be made during the design phase of the project.

6.3.3.3. Cost

The estimated total capital cost for implementing this alternative is $1,670,000. The long-term total cost for implementing this alternative is $2,480,000, with a present value cost of $2,260,000. Appendix D provides the detailed cost estimate. The following major assumptions have been identified for Alternative 2B:

- Site personnel would consist of a site superintendent, a site QC engineer who would also provide health and safety oversight, and up to three operators, five truck drivers, and one laborer.
- A large tracked excavator would be used to excavate source materials. Four off-road haul trucks would be used to transport source material. Other heavy equipment would include a skidsteer, bulldozer, compactor, backhoe, and a water truck.

- The estimated duration of field activities would be 65 days.
- Estimated quantity of material to be excavated and transported is 30,210 cubic yards (1,290 cubic yards of lead impacted materials will be consolidated in place at the Open Pit).
- Estimated amount of asphalt is 64,500 square feet
- Source material would be approximately 20 feet thick over 64,000 square feet.
- No major road improvements would need to be performed.
- No liner would be necessary for encapsulation.
- Two weeks would be needed for preparation of implementation plans (Work Plan, Health and Safety Plan, etc.) and of the removal action completion report.
- Up to 4 acres would be hydroseeded or hand broadcast with native seed.

6.3.4. Alternative 3A: Excavation and Onsite Encapsulation of Source Materials (Two Encapsulation Units, Soil Cover)

Under Alternative 3A, all source materials (i.e., mine waste rock and tailings) and building foundations at the Mill Site would be removed and transported to two onsite encapsulation units. One unit would be located at the Open Pit, and one unit would be located at the Mill Site. Source materials from the Open Pit Area (9,865 cubic yards) and the Adit/Pond Area (20,000 cubic yards) would be excavated, transported, and consolidated in the encapsulation unit at the Open Pit Area as described for Alternative 2B (Sections 6.3.2 and 2.3.3). Since the volume of waste would be slightly reduced compared to Alternatives 2A and 2B, the area of the encapsulation unit at the Open Pit would cover 60,750 square feet, rather than the 64,000 square feet under Alternatives 2A and 2B. Source materials at the Mill Site (1,520 cubic yards) would be consolidated and encapsulated in place, as described below.

Source material at the Mill Site would be consolidated within and around the foundations of the former Mill Building and then encapsulated in place. Source material would be placed on top of the existing foundations and used to fill in foundation terraces to achieve a level surface profile. Source materials at the Mill Site are within 100 feet of the proposed encapsulation area so a minimum level of effort would be required to consolidate the materials. A 2-foot-thick clean soil cap would be constructed over the waste with a brightly colored demarcation layer, as described for Alternative 2A (Section 6.3.2). The soil cover would extend beyond the edges of the current foundation and slope down to meet the existing grade. The cover is anticipated to cover an area of approximately 30,000 square feet. Following the consolidation of source materials and construction of the encapsulation unit at the Mill Site, all three areas would be restored to as close to natural conditions as possible as described for Alternative 2A (Section 6.3.2).

6.3.4.1. Effectiveness

The effectiveness of Alternative 3A is the same as for Alternative 2A (see Section 6.3.2.1).

6.3.4.2. Implementability

For the most part, Alternative 3A has the same technical and administrative implementability as Alternative 2A (see Section 6.3.2.2). The Open Pit and Mill Site would both be suitable locations for onsite encapsulation units because they are relatively open, with gradual slopes (1:2 and 1:3), virtually no vegetation, and cover an area of approximately 2.75 acres at the Open Pit and approximately 1 acre at the Mill Site. Both locations have enough capacity to accept the estimated volume of source material (31,500 cubic yards) from the Open Pit Area, Adit/Pond Area, and the Mill Site (Figure 6). Specifically, the Mill Site has the capacity to accommodate approximately 1,520 cubic yards of source material that would be encapsulated at this location. Because the Mill Site is about 1 mile away from the Open Pit Area, consolidation and encapsulation within the Mill Site would require hauling of waste a shorter distance to the encapsulation unit, but a longer haul distance for imported cover material from Titlow Hill Road. Additionally, long-term inspection and maintenance would need to be performed for both encapsulation units.

This alternative would likely be acceptable to the state and the community because it would meet the RAOs, would improve the site for recreational use, and would require minimal long-term maintenance. The final decision regarding the location of the encapsulation units would be made during the design phase of the project.

6.3.4.3. Cost

The estimated total capital cost for implementing this alternative is $1,360,000. The long-term total cost for implementing this alternative is $2,210,000, with a present value cost of $1,990,000. Appendix D provides the detailed cost estimate. The following major assumptions have been identified for Alternative 3A:

- Site personnel would consist of a site superintendent, a site QC engineer who would also provide health and safety oversight, and up to three operators, five truck drivers, and one laborer.
- A large tracked excavator would be used to excavate source materials. Four off-road haul trucks would be used to transport the material. Other heavy equipment includes a skidsteer, bulldozer, compactor, backhoe, and a water truck.
- The estimated duration of field activities would be 59 days.
- Estimated quantity of material to be excavated is 29,935 cubic yards (275 cubic yards of foundation would remain in place at the Mill Site and 1,290 cubic yards of lead-impacted materials would be consolidated in place at the Open Pit).
- Estimated amount of cover material is 10,800 tons for the 2-foot soil cover (assuming 1.6 tons = 1 compacted cubic yard). Of this, 7,200 tons would be used for the cap at the Open Pit and 3,600 tons for the cap at the Mill Site.
- Source material would be approximately 20 feet thick over 60,750 square feet at the Open Pit.

- Area to be capped at the Mill Site is 30,000 square feet.
- A 2-foot-thick soil cover would be installed at both the Open Pit and the Mill Site.
- A local quarry would be used to obtain clean cover material and could deliver at least 500 cubic yards per day.
- Imported soil would be weed free (approved by the Forest Service) to ensure that no non-native species are introduced into the Horse Mountain Botanical Area.
- No major road improvements would need to be performed.
- No liner would be necessary for encapsulation
- Two weeks would be allowed for preparation of implementation plans (Work Plan, Health and Safety Plan, etc.) and of the removal action completion report.
- Up to 5.5 acres would be hydroseeded or hand broadcast with native seed

6.3.5. Alternative 3B: Excavation and Onsite Encapsulation of Source Materials (Two Encapsulation Units, Asphalt Cover)

Under Alternative 3B, all source materials (i.e., mine waste rock and tailings) and building foundations at the Mill Site would be removed and transported to two encapsulation units at the Open Pit and the Mill Area, as described under Alternative 3A. Instead of a clean soil cover being installed, source materials would be encapsulated with an asphalt cover.

6.3.5.1. Effectiveness

The effectiveness of Alternative 3B is the same as for Alternatives 2A, 2B, and 3A (see Section 6.3.2.1). Asphalt is an effective durable cover for waste encapsulation.

6.3.5.2. Implementability

Alternative 3B has the same technical and administrative implementability as Alternatives 2A, 2B, and 3A (see Section 6.3.2.2). Additionally, long-term inspection and maintenance would need to be performed. This alternative would likely be acceptable to the state and the community because it would meet the RAOs, would improve the site for recreational use, and would require minimal long-term maintenance. The final decision regarding the location of the encapsulation unit would be made during the design phase of the project.

6.3.5.3. Cost

The estimated total capital cost for implementing this alternative is $1,650,000. The long-term total cost for implementing this alternative is $2,580,000, with a present value cost of $2,330,000. Appendix D provides the detailed cost estimate. The following major assumptions have been identified for Alternative 3B:

- Site personnel would consist of a site superintendent, a site QC engineer who would also provide health and safety oversight, and up to three operators, five truck drivers, and one laborer.
- A large tracked excavator would be used to excavate source materials. Four off-road haul trucks would be used to transport the material. Other heavy equipment includes a skidsteer, bulldozer, compactor, backhoe, and a water truck.
- The estimated duration of field activities would be 50 days.
- Estimated quantity of material to be excavated is 29,935 cubic yards (275 cubic yards of foundation would remain in place at the Mill Site and 1,290 cubic yards of lead-impacted materials would be consolidated in place at the Open Pit).
- Source material would be approximately 20 feet thick over 60,750 square feet at the Open Pit.
- Area to be capped with asphalt is 90,750 square feet; 30,000 square feet at the Mill Area and 60,750 square feet at the Open Pit.
- No major road improvements would need to be performed.
- No liner would be necessary for encapsulation
- Two weeks would be allowed for preparation of implementation plans (Work Plan, Health and Safety Plan, etc.) and of the removal action completion report.
- Up to 4 acres would be hydroseeded or hand broadcast with native seed

6.3.6. Alternative 4: Excavation and Offsite Disposal of Source Materials

Alternative 4 is similar to Alternatives 2A, 2B, 3A, and 3B in that source materials (i.e., mine waste rock and tailings) would be removed and the site would be restored; however, the source materials would be disposed of at an offsite facility rather than encapsulated on site. In total, approximately 31,500 cubic yards would be excavated and removed from the site. Prior to the start of removal activities, waste samples would be collected for analysis to characterize the waste for acceptance at an appropriate disposal facility. Because asbestos is likely to be present in the waste to be removed, the facility will need to be asbestos-certified (e.g., Vacaville Landfill, in Vacaville, California, approximately 315 miles from the site)[4]. The site access road is in good condition; however, to accommodate heavy use by large 2-wheel drive haul trucks, some minimal repairs and grading of staging areas would be necessary under this alternative. A large tracked excavator would be used to excavate the source material. Where possible, the excavator would load the source material directly into haul trucks. In areas where direct loading is not possible, a front-end loader would be used to shuttle, stockpile, and load source materials into dump trucks for offsite disposal. To the extent practicable, the excavated areas would be regraded to match pre-mining conditions and natural contours of the area. The same basic equipment and techniques presented under Alternatives 2A, 2B, 3A, and 3B would be used to excavate source materials and restore the excavated areas.

[4] A closer landfill, permitted to accept the anticipated waste streams is located in Anderson, California, but stated they would not be able to accept the anticipated waste volume when contacted during this EE/CA.

6.3.6.1. Effectiveness

Alternative 4 would provide the most overall protection of human health and the environment because contaminated source materials would be removed from the site, thus completely removing the long-term risk to human health and the environment. Periodic monitoring of metals concentrations in sediments at and downstream of the creek would be conducted to evaluate the long-term health of the creek. Long-term periodic inspection or maintenance would not be required. In all other aspects, Alternative 4 has the same effectiveness as Alternatives 2A, 2B, 3A, and 3B (see Sections 6.3.2.1, 6.3.3.1, 6.3.4.1, and 6.3.5.1).

6.3.6.2. Implementability

Alternative 4 is considered technically feasible and equipment and materials are readily available in the vicinity of the site, either from the community of Willow Creek or from the Eureka area. However, disposal services are not readily available near the site. The closest landfill that would accept the anticipated volume of waste materials with asbestos is located in Vacaville, California, which is 315 miles away from the site. Excavation and offsite disposal is a proven method for removing the exposure pathway to site receptors and the risk posed to human health and the environment. This alternative could be implemented in a way that would minimize environmental impacts; however, the project duration of construction may require that work be performed during two construction seasons. Off-hauling of waste from the site is estimated to take 199 days because space at the site for loading trucks is limited and the distance to the nearest appropriately permitted disposal facility is approximately 315 miles. The daily rate for the export of waste material will also be slowed down by handling requirements for asbestos containing material which will impact loading rates. The site access road is in good condition; however, to accommodate heavy use by large haul trucks, some minimal repairs and grading of staging areas may be necessary. Permits, access agreements and easements are either not required or would be granted by the Forest Service, which is both the property owner and is acting as the lead agency in this removal action. A Remedial Design and a Work Plan, with an associated sampling and analysis plan and site-specific health and safety plan, would be required prior to the start of work. No impacts to adjacent property are anticipated for this action.

This alternative would likely be acceptable to the state and the community because it would meet the RAOs, would improve the site for recreational use, and would require minimal long-term maintenance.

6.3.6.3. Cost

The estimated total capital cost for implementing this alternative is $7,910,000. The long-term total cost for implementing this alternative is $7,920,000, with a present value cost of $7,920,000. Appendix D provides the detailed cost estimate. The following major assumptions have been identified for Alternative 4:

- Site personnel would consist of a site superintendent, a site QC engineer who would also provide health and safety oversight, and up to three operators, five truck drivers, and one laborer.
- A large tracked excavator would be used to excavate source materials. Four off-road haul trucks would be used to transport material. Other heavy equipment would include a skidsteer, bulldozer, compactor, backhoe, and a water truck.
- The estimated duration of field activities would be 184 days.
- Estimated quantity of material to be excavated is 31,500 cubic yards.
- Assumes, Class II landfill with bulk asbestos certificate in Vacaville, California, would be able to accept waste material.
- Minimal road improvements may need to be performed to accommodate heavy use by haul trucks.
- Two weeks would be allowed for preparation of implementation plans (Work Plan, Health and Safety Plan, etc.) and of the removal action completion report.
- Up to 4 acres would be hydroseeded or hand broadcast with native seed.

Section 7. Comparative Analysis of and Recommended Removal Action Alternatives

The removal action alternatives identified in Section 6.3 were compared with one another by using the evaluation criteria described in Section 6.2. Section 7.1 describes the results of the comparative analysis. Table 13 presents the comparative analysis of the alternatives for removal and either onsite encapsulation or offsite disposal of source materials. Section 7.2 provides the recommended removal action based on the results of the comparative analysis.

7.1. COMPARATIVE ANALYSIS OF ALTERNATIVES

7.1.1. Effectiveness

Alternative 1 is considered the least effective alternative to protect public health and the environment because risks to current and future receptors would remain indefinitely and the toxicity, mobility, and volume of contamination would not be reduced through either treatment or removal. Alternatives 2A, 2B, 3A, 3B, and 4 would not reduce the toxicity, mobility, and volume of contamination through treatment. Alternatives 2A, 2B, 3A, and 3B are considered equally effective alternatives to protect public health and the environment because risks to current and future receptors would be reduced by removal and onsite encapsulation of source materials. Alternative 4 would be the most effective alternative because source materials would be completely removed from the site, thus the risk to current and future receptors would be eliminated.

7.1.2. Implementability

The six alternatives are technically and administratively feasible, and the services and materials necessary to implement the alternative are readily available. Alternative 1 is the most implementable because no administration, services, or materials are required. Alternatives 2A, 2B, 3A, and 3B are very implementable and could be conducted within one construction season. Alternative 4 is moderately implementable. Although it is technically and administratively feasible, the required disposal services are not readily available (i.e., nearest waste disposal facility is 315 miles from the site). Because of the remote location of the site and the distance to the nearest landfill, Alternative 4 would require more time than Alternatives 2A, 2B, 3A, and 3B and may need to be conducted during two construction seasons.

7.1.3. Cost

The estimated cost for Alternative 1 is $0. The estimated capital cost for Alternative 2A is $1,480,000, and the total cost with ongoing maintenance is $2,210,000. The estimated capital cost for Alternative 2B is $1,670,000, and the total cost with ongoing maintenance is $2,480,000. The estimated capital cost for Alternative 3A is $1,360,000, and the total cost with ongoing maintenance is $2,210,000. The estimated capital cost for Alternative 3B is $1,650,000, and the total cost with ongoing maintenance is $2,580,000. The estimated capital cost for Alternative 4 is $7,910,000, and the total cost with ongoing maintenance is $7,920,000. Capital and long-term costs for Alternatives 2A, 2B, 3A, and 3B are similar but Alternatives 2A and 2B are slightly more cost-effective overall.

7.2. RECOMMENDED REMOVAL ACTION ALTERNATIVE

The removal action alternative recommended for the Horse Mountain Mine and Mill Site is **Alternative 2A, Excavation and Onsite Encapsulation of Source Materials (One Encapsulation Unit, Soil Cover)**. Alternative 2A would meet the RAOs at the site and is more cost effective than Alternative 2B. Alternative 2A is preferable to Alternative 3A and 3B because the removal of source materials to a single onsite encapsulation unit would consolidate all of the source material in one location, which would reduce the amount of required future maintenance and repair work[5]. The level of protection under Alternative 2A is less than afforded by Alternative 4 although both meet the RAOs, but the cost for Alternative 4 is significantly more expensive than Alternative 2A.

The primary components of the recommended alternative are as follows:

- A topographic survey would be conducted to establish the volume of waste to be removed.
- An engineering design would be completed for an onsite encapsulation unit and restoration of the excavations and creek bank. The design would identify an appropriate site for the onsite encapsulation unit and outline required testing to be performed prior to building the encapsulation unit. The onsite encapsulation design would be reviewed by a professional engineer, as well as the applicable regulatory agencies, prior to mobilization to the site.
- An evaluation of strategies for reducing the risk to Port-Orford-cedar from root disease would be completed prior to the start of site work.
- An offsite backfill source would be identified and tested for geotechnical and chemical properties to ensure a suitable material for restoration of the creek bank.
- The current access route to the creek banks would not require major improvements to support the removal activities.
- Temporary sandbags would be placed in the unnamed tributary on the upstream side of the work areas, and water would be temporarily diverted away from the work area.

[5] Because the costs for Alternatives 2A and 3A are so similar, the design should consider both alternatives as appropriate.

- The source material on the creek banks of the unnamed tributary would be excavated and hauled to the onsite stockpile area. The excavated material would be placed inside the encapsulation unit and compacted by a loader and a bulldozer.
- Eighteen inches of soil would be removed from two shooting areas (one adjacent to the Open Pit and one at the Mill Site) for encapsulation in the Open Pit Area. Lead-contaminated waste within the Open Pit would be consolidated into the encapsulation unit as needed based on the final location of the unit.
- After all source materials are excavated (estimated 31,500 cubic yards), regrading would be conducted along the creek banks to restore them to as close to pre-mining conditions as possible. After regrading is completed, minimal amounts of riprap (approximately 10 tons) may be placed at the toe of the backfill for erosion control.
- The surface of the soil cap and restored areas would be covered with erosion control mats and hydroseeded, hand broadcast, and/or live-staked with native plants for slope stabilization as needed. Straw wattle would be installed along contours as an erosion control measure.
- The final location for the encapsulation unit would be determined in consultation with the Forest Service and specified in the removal action design. After all source materials are placed inside the encapsulation unit, a 2-foot-thick soil cap would be placed on top of the compacted source materials (specifications for the soil cap would be included in the final design).
- Imported soil would be weed free (approved by the Forest Service) to ensure that no non-native species are introduced into the Horse Mountain Botanical Area.
- After the removal action is complete, a focused monitoring and inspection program would be implemented during the first 12 months of the long-term maintenance program to ensure the planted vegetation is growing and meets design specifications and the erosion controls are functioning as intended.
- After the first year, periodic inspection and maintenance activities would be performed in subsequent years to maintain the integrity of the soil cap and the restored creek banks.

The estimated total capital cost for implementing this alternative is $1,480,000. The long-term total cost for implementing this alternative is $2,210,000, with a present value cost of $2,020,000. As discussed in Section 6.2.3, this cost represents an order-of-magnitude estimate with an intended accuracy of +50 to -30 percent (EPA, 2000). Final project costs will depend on actual labor and material costs, actual engineering design costs, actual site conditions (including the actual quantities of source materials excavated and the amount of material that may be classified as hazardous waste), competitive market conditions, the final project scope, the final project schedule, and other variables.

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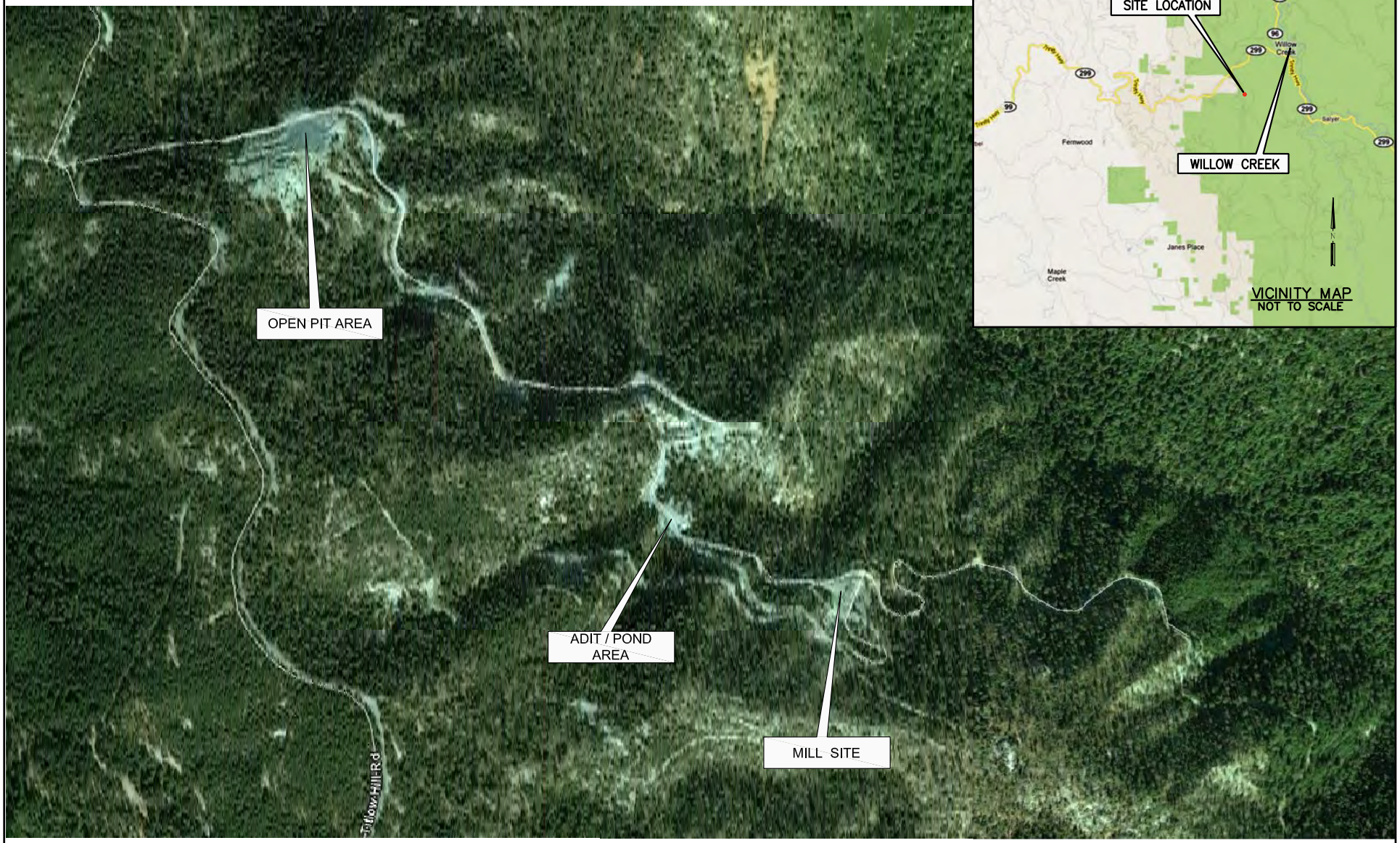
Figures



SOURCE: GOGGLE MAPS

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APPROXIMATE SCALE: 1"=500'

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CLIENT: U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE

LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST

SITE LOCATION AND VICINITY MAP

DRAWN BY:	CHECKED BY:	PROJECT NO.	FIG NO.
SC 11/15/11	RWP 11/15/11	2011-119	1

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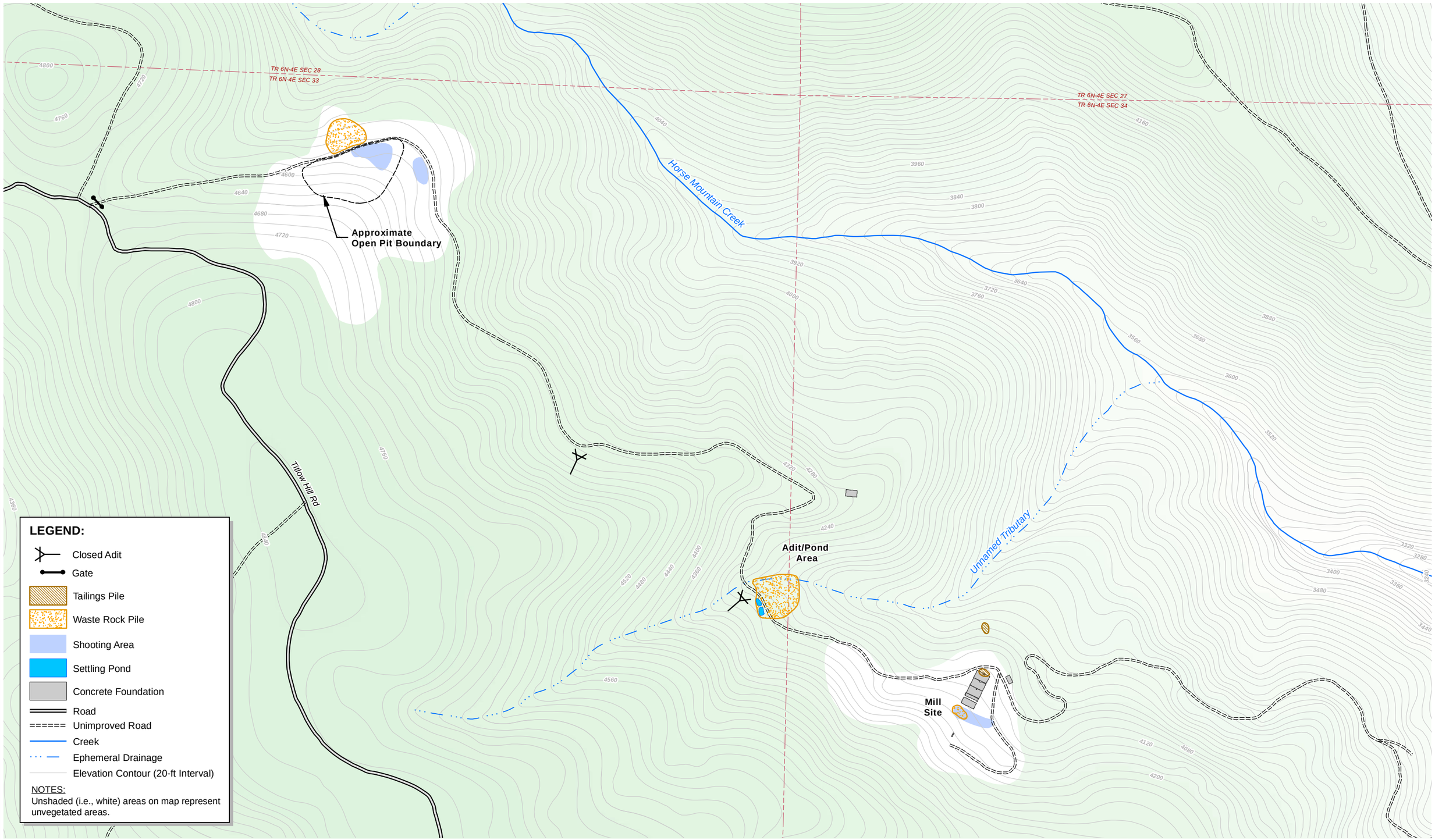

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PROJECTION: UNIVERSAL TRANSVERSE MERCATOR ZONE 10 NORTH, NORTH AMERICAN DATUM 1983

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SCALE: 1" = 500'

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CLIENT: U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE	SITE FEATURES			
LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST	DRAWN BY: JJC 1/22/2013	CHECKED BY: SCK 1/22/2013	PROJECT NO. 2011-119	FIG NO. 2

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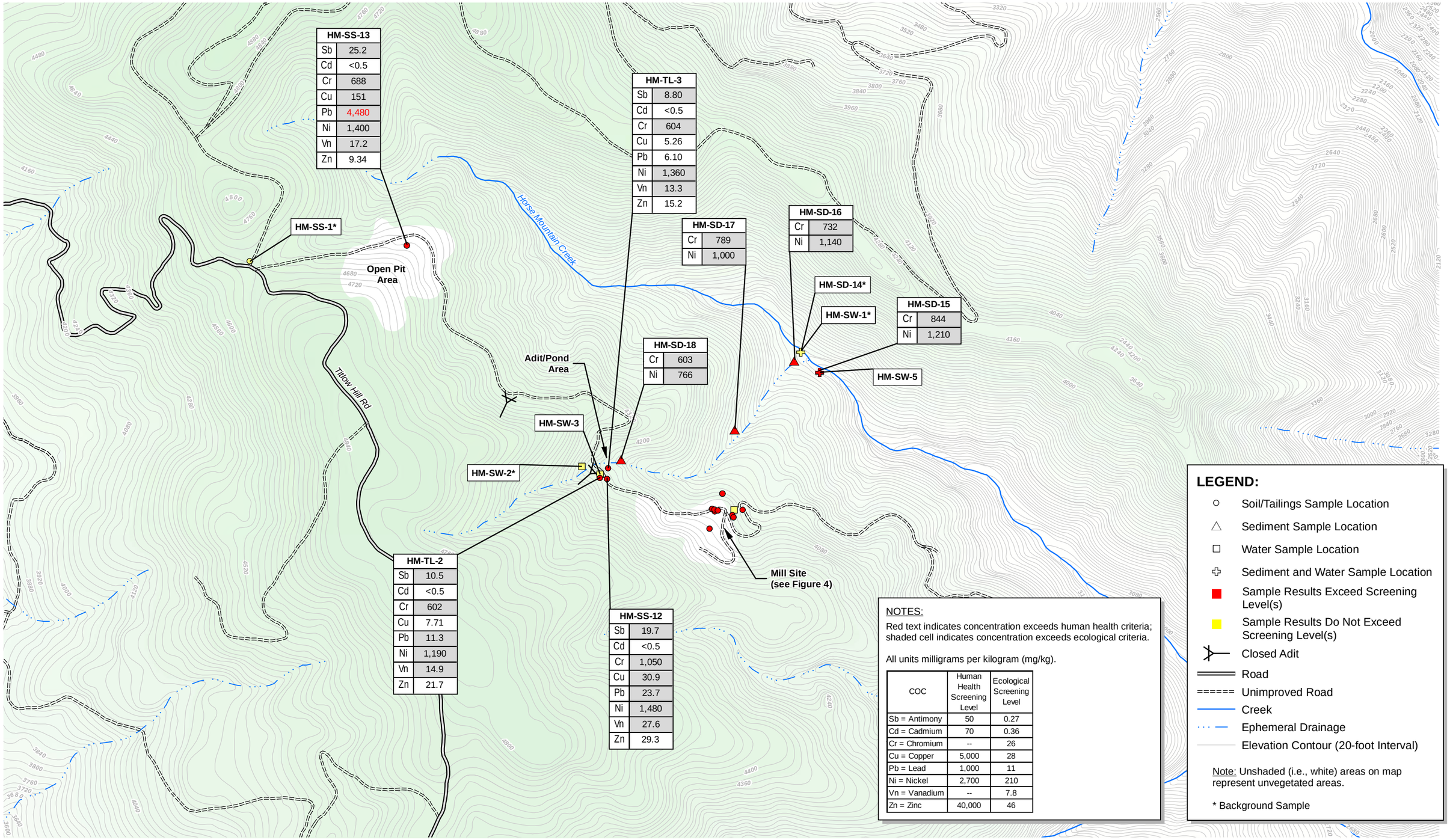

NOTES:

Red text indicates concentration exceeds human health criteria; shaded cell indicates concentration exceeds ecological criteria.

All units milligrams per kilogram (mg/kg).

COC	Human Health Screening Level	Ecological Screening Level
Sb = Antimony	50	0.27
Cd = Cadmium	70	0.36
Cr = Chromium	--	26
Cu = Copper	5,000	28
Pb = Lead	1,000	11
Ni = Nickel	2,700	210
Vn = Vanadium	--	7.8
Zn = Zinc	40,000	46

LEGEND:

- Soil/Tailings Sample Location
- Sediment Sample Location
- Water Sample Location
- Sediment and Water Sample Location
- Sample Results Exceed Screening Level(s)
- Sample Results Do Not Exceed Screening Level(s)
- Closed Adit
- Road
- Unimproved Road
- Creek
- Ephemeral Drainage
- Elevation Contour (20-foot Interval)

Note: Unshaded (i.e., white) areas on map represent unvegetated areas.

* Background Sample

SOURCES: USGS 7.5' TOPOGRAPHIC QUADRANGLE OF GROUSE MOUNTAIN, CA (1979); ELEVATION CONTOURS DERIVED FROM A USGS 7.5' 10-METER RESOLUTION DIGITAL ELEVATION MODEL (DEM) OF GROUSE MOUNTAIN, CA (2001)
PROJECTION: UNIVERSAL TRANSVERSE MERCATOR ZONE 10 NORTH, NORTH AMERICAN DATUM 1983

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SCALE: 1" = 1,000'

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CLIENT:	DRAWN BY:	CHECKED BY:	PROJECT NO.	FIG NO.
U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE	JJC 1/22/2013	SCK 1/22/2013	2011-119	3
LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST				

DISTRIBUTION OF METALS AT OPEN PIT AND ADIT/POND AREAS

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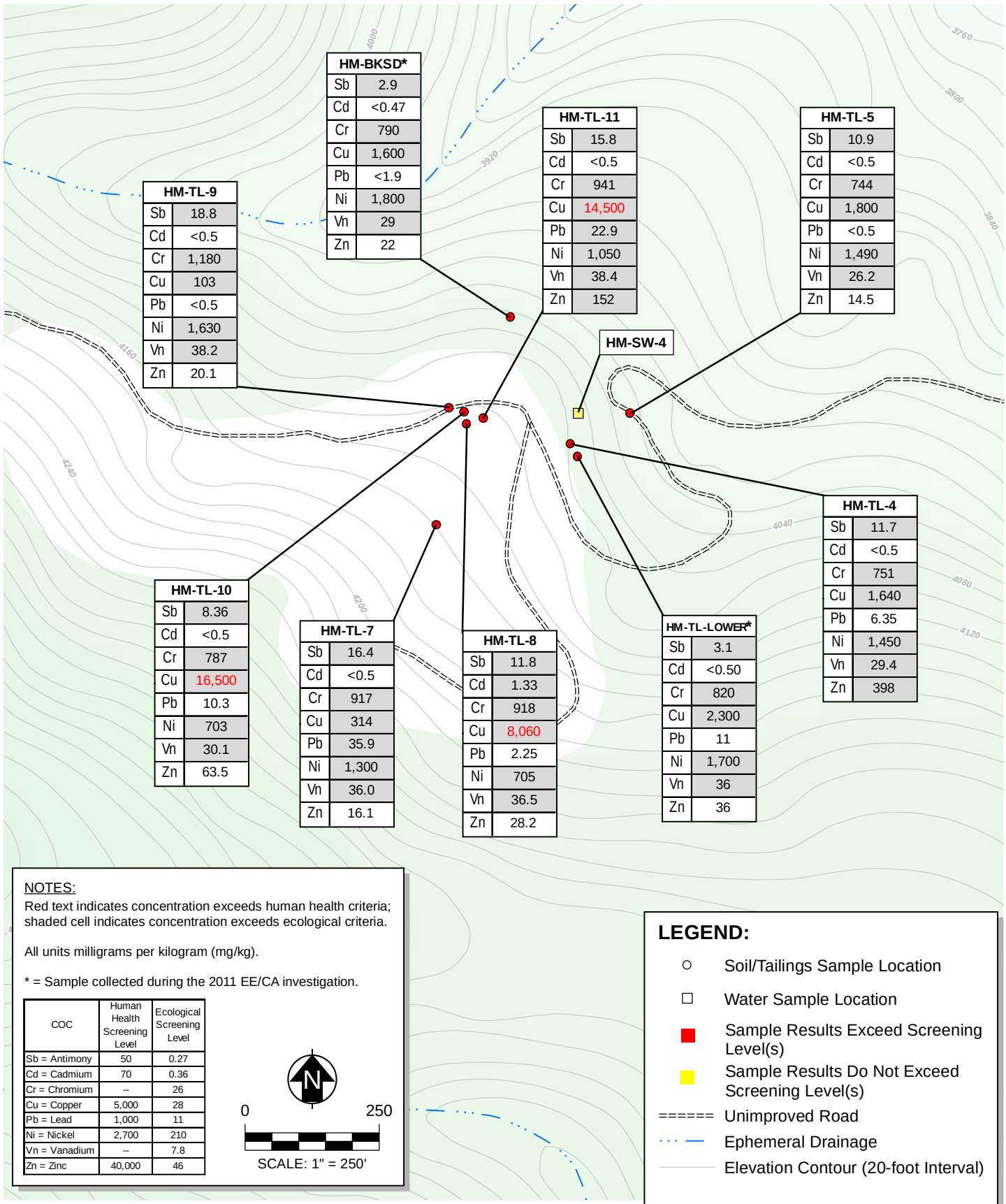

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PROJECTION: UNIVERSAL TRANSVERSE MERCATOR ZONE 10 NORTH, NORTH AMERICAN DATUM 1983

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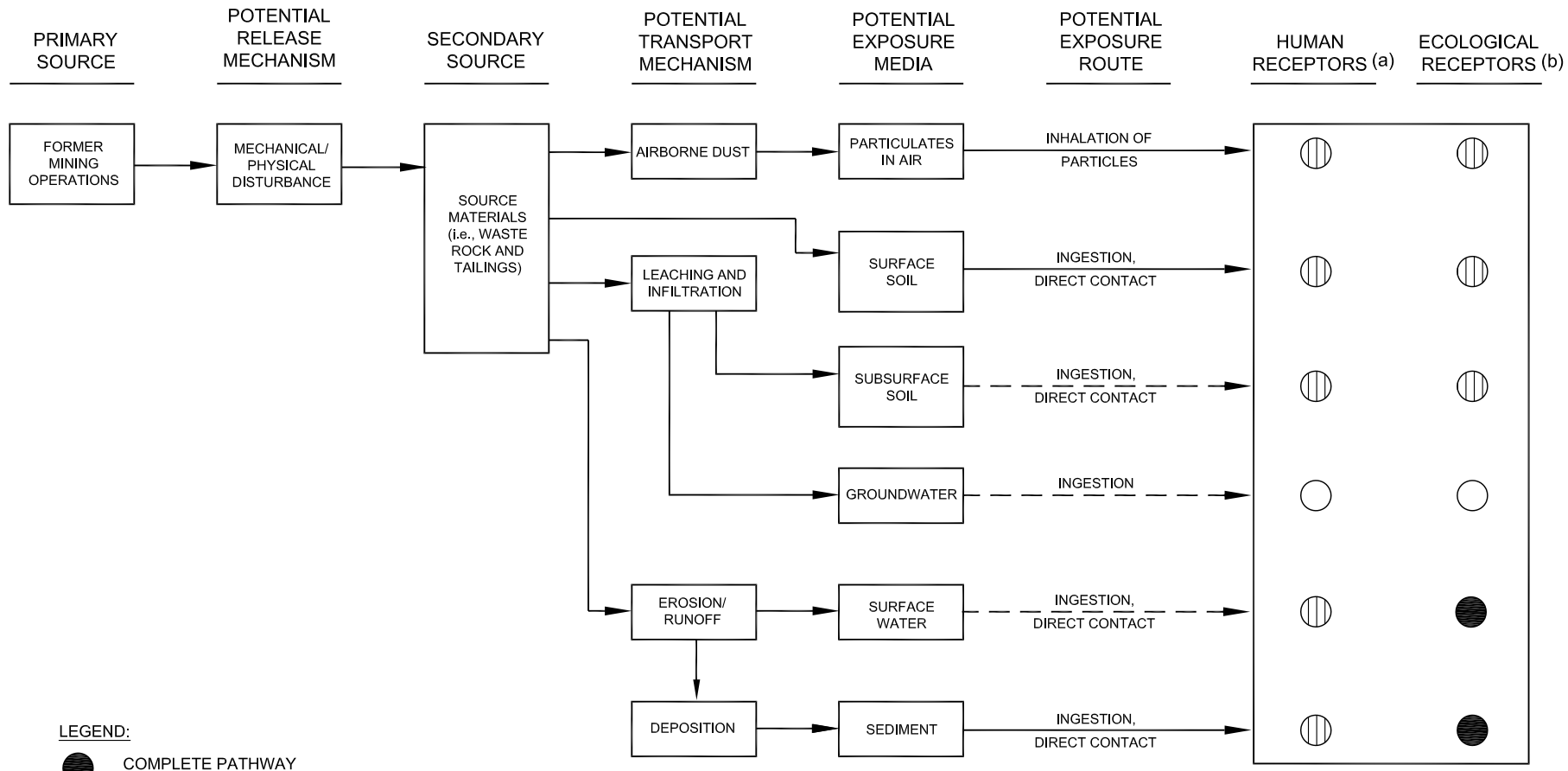
CLIENT:	DISTRIBUTION OF METALS AT THE MILL SITE			
U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE				
LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST	DRAWN BY: JJC 1/22/2013	CHECKED BY: SCK 1/22/2013	PROJECT NO. 2011-119	FIG NO. 4



LEGEND:

- COMPLETE PATHWAY
- POTENTIALLY COMPLETE PATHWAY BUT INSIGNIFICANT EXPOSURE (NOT TO BE QUANTIFIED)
- INCOMPLETE PATHWAY (NOT TO BE QUANTIFIED)
- INSIGNIFICANT OR INCOMPLETE PATHWAY OR MEDIUM
- COMPLETE PATHWAY OR MEDIUM

(a) HUMAN RECEPTORS INCLUDE RECREATIONAL VISITORS, FUTURE CONSTRUCTION WORKERS, FOREST SERVICE PERSONNEL, AND DOWNSTREAM RESIDENTS, WHO USE WILLOW CREEK AS WATER SOURCE

(b) ECOLOGICAL RECEPTORS INCLUDE FISH, BIRDS, AND MAMMALS

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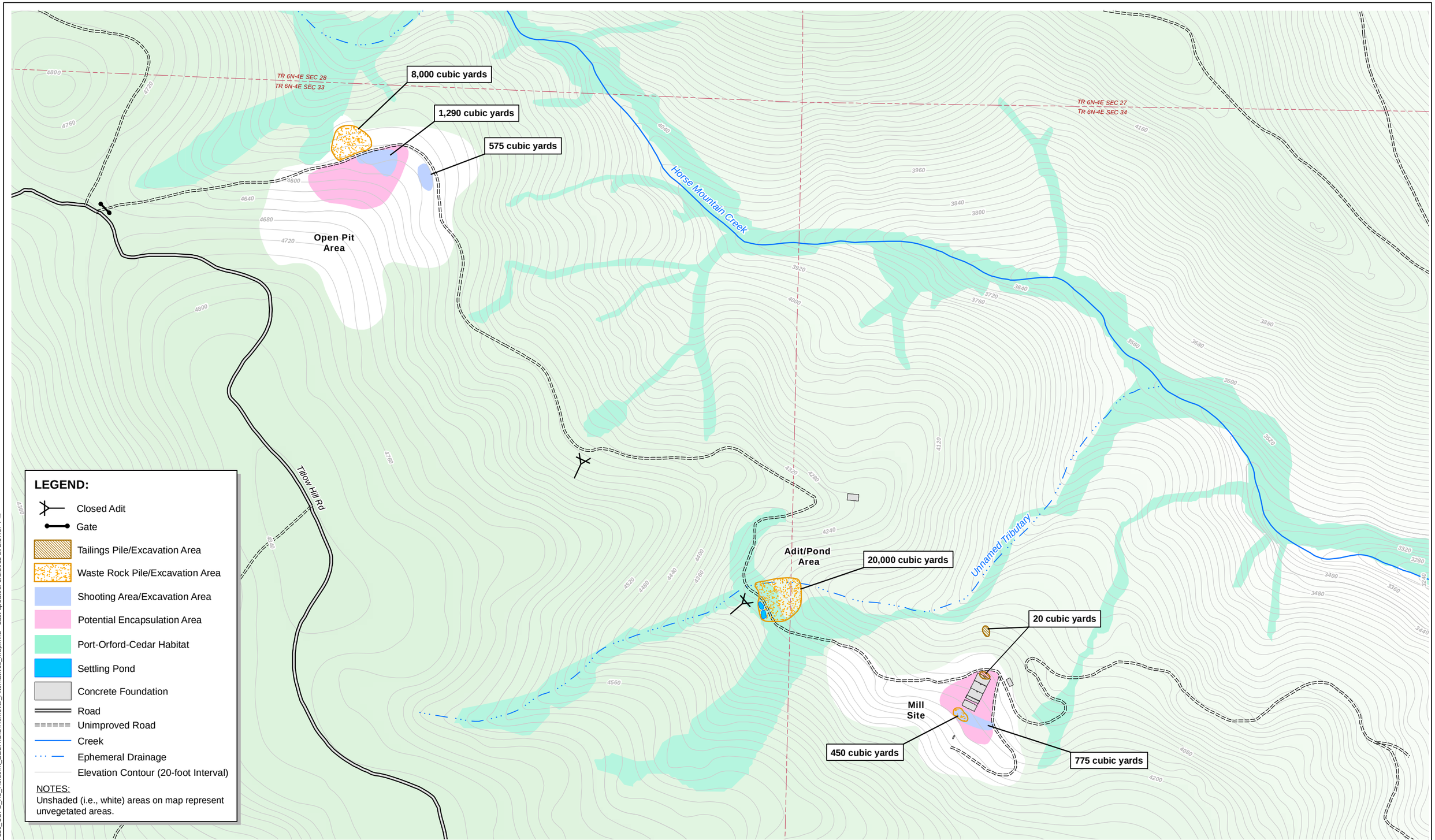
CLIENT: U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE

LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST, CALIFORNIA

SITE CONCEPTUAL EXPOSURE MODEL FOR METALS

DRAWN BY:	CHECKED BY:	PROJECT NO.	FIG NO.
SC 02/14/13	SKC 02/14/13	2011-119	5

FILE NAME: N:\Graphics\2011\2011-119_USFS_R5_HorseMt_EECA\Fig5-2013.dwg LAYOUT NAME: 5 PLOTTED: Friday, March 22, 2013 - 12:31pm



SOURCES: USGS 7.5' TOPOGRAPHIC QUADRANGLE OF GROUSE MOUNTAIN, CA (1979);
ELEVATION CONTOURS DERIVED FROM A USGS 7.5' 10-METER RESOLUTION DIGITAL ELEVATION MODEL (DEM) OF GROUSE MOUNTAIN, CA (2001)
PORT ORFORD CEDAR LAYER PROVIDED BY U.S.D.A FOREST SERVICE (2013)
PROJECTION: UNIVERSAL TRANSVERSE MERCATOR ZONE 10 NORTH, NORTH AMERICAN DATUM 1983

N

0 500
SCALE: 1" = 500'

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CLIENT: U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE	PROPOSED REMOVAL ACTION AREAS			
LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST	DRAWN BY: JJC 1/22/2013	CHECKED BY: SCK 1/22/2013	PROJECT NO. 2011-119	FIG NO. 6

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Tables

Table 1. Sensitive Animal Species Potentially Present in the Vicinity of the Horse Mountain Mine and Mill Site

Common Name	Scientific Name	Federal Status	California Status	Regulatory Agency Status
Amphibians				
Del Norte Salamander[1,2]	*Plethodon elongatus*	None	None	CDFG California Species of Special Concern, Forest Service Sensitive Species
Foothill Yellow-Legged Frog[1,2]	*Rana boylii*	None	None	CDFG California Species of Special Concern, Forest Service Sensitive Species
Pacific Tailed Frog[1,2]	*Ascaphus truei*	None	None	CDFG California Species of Special Concern, Forest Service Sensitive Species
Southern Torrent Salamander[1,2]	*Rhyacotriton variegatus*	None	None	CDFG California Species of Special Concern, Forest Service Sensitive Species
Fish				
Chinook Salmon (spring-run Klamath-Trinity Rivers population)[2]	*Oncorhynchus tshawytscha*	None	None	CDFG California Species of Concern
Steelhead Trout (Summer-run)[1]	*Oncorhynchus mykiss irideus*	None[3]	None[3]	CDFG California Species of Special Concern
Birds				
Bald Eagle[1,2]	*Haliaeetus leucocephalus*	Delisted	Endangered	Federally Fully Protected
Northern Spotted Owl[2]	*Strix occidentalis caurina*	Threatened	None	CDFG California Species of Special Concern
Osprey[1,2]	*Pandion haliaetus*	None	None	CDFG California Watch list
Mammals				
Humboldt Marten[1]	*Martes americana humboldtensis*	None	None	CDFG California Species of Concern
Pacific Fisher[1,2]	*Martes pennanti (pacifica)*	Candidate	None	CDFG California Species of Concern; DPS
Sonoma Tree Vole[1]	*Arborimus pomo*	None	None	CDFG California Species of Special Concern

Table 1. Sensitive Animal Species Potentially Present in the Vicinity of the Horse Mountain Mine and Mill Site *(continued)*

Notes:

1 = Identified using http://imaps.dfg.ca.gov/viewers/cnddb_quickviewer/app.asp in quadrants surrounding the site, located at Grouse Mountain Quadrant (Maple Creek, Lord Ellis Summit, and Willow Creek).

2 = Identified using http://imaps.dfg.ca.gov/viewers/cnddb_quickviewer/app.asp in Grouse Mountain Quadrant (which includes project site).

3 = Species is listed as Threatened in most of California, but the population in the Klamath Mountains Province of the site has been designated "not warranted" by NOAA (2013b).

CDFG = California Department of Fish and Game

DPS = Distinct population segment

NOAA = National Oceanographic and Atmospheric Administration

Source:

NOAA, 2013b. "Klamath and Trinity Rivers Chinook ESU, Not Warranted." National Marine Fisheries Service, Northwest Regional Office. Website accessed on January 21: <http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Steelhead/>.

Table 2. Sensitive Plant Species Potentially Present in the Vicinity of the Horse Mountain Mine and Mill Site

Common Name	Scientific Name	Federal Status	California Status	California Native Plant Society Status
Bald Mountain Milk Vetch[1]	*Astragalus umbraticus*	None	None	Plants rare, threatened, or endangered in California, but more common elsewhere
Bensoniella[1]	*Bensoniella oregana*	None	Rare	Plants rare, threatened, or endangered in California and elsewhere
California Globe Mallow[1,2]	*Iliamna latibracteata*	None	None	Plants rare, threatened, or endangered in California and elsewhere
California Lady's Slipper[1]	*Cypripedium californicum*	None	None	Plants rare, threatened, or endangered in California, but more common elsewhere
Coast Fawn Lily[1,2]	*Erythronium revolutum*	None	None	Plants rare, threatened, or endangered in California, but more common elsewhere
California Pinefoot[1]	*Pityopus californica*	None	None	Plants rare, threatened, or endangered in California, but more common elsewhere
Evergreen Everlasting[1,2]	*Antennaria suffrutescens*	None	None	Plant of limited distribution or plant about which we need further information
Geyer's Sedge[2]	*Carex geyeri*	None	None	Plants rare, threatened, or endangered in California and elsewhere
Giant Fawn Lily[1]	*Erythronium oregonum*	None	None	Plants rare, threatened, or endangered in California, but more common elsewhere
Howell's Montia[1,2]	*Montia howellii*	None	None	Plants rare, threatened, or endangered in California, but more common elsewhere
Heart-Leaved Twayblade[1,2]	*Listera cordata*	None	None	Plants rare, threatened, or endangered in California and elsewhere
Kellogg's Lily[1]	*Lilium kelloggii*	None	None	Plant of limited distribution, plant about to which we need further information
Leafy Stemmed Mitrewort[1]	*Mitellastra caulescens*	None	None	Plants about which more information is needed

Table 2. Sensitive Plant Species Potentially Present in the Vicinity of the Horse Mountain Mine and Mill Site *(continued)*

Common Name	Scientific Name	Federal Status	California Status	California Native Plant Society Status
Lemon Colored Fawn Lily[1]	*Erythronium citrinum var. citrinum*	None	None	Plants about which more information is needed
Maple-Leaved Checkerbloom[1]	*Sidalcea malachroides*	None	None	Plants rare, threatened, or endangered in California, but more common elsewhere
Nodding Semaphore Grass[1,2]	*Pleuropogon stricta*	None	None	Plants rare, threatened, or endangered in California and elsewhere
Northern Clustered Sedge[1]	*Carex arcta*	None	None	Plants rare, threatened, or endangered in California, but more common elsewhere
Pacific Gilia[1]	*Gilia capitata ssp. pacifica*	None	None	Plants rare, threatened, or endangered in California and elsewhere
Redwood Lily[1]	*Lilium rubescens*	None	None	Plants rare, threatened, or endangered in California and elsewhere
Robust False Lupine[1]	*Thermopsis robusta*	None	None	Plants rare, threatened, or endangered in California, but more common elsewhere
Running Pine[1]	*Lycopodium clavatum*	None	None	Plants of limited distribution - a watch list. Plants rare, threatened, or endangered in California, but more common elsewhere
Sender Bog Orchid[2]	*Platanthera stricta*	None	None	Plants rare, threatened, or endangered in California and elsewhere
Serpentine Arnica[1,2]	*Arnica cernua*	None	None	Plants about which we need more information
Siskiyou Checkerbloom[1]	*Sidalcea malviflora ssp. patula*	None	None	Plants rare, threatened, or endangered in California and elsewhere
Siskiyou Onion[2]	*Allium siskiyouense*	None	None	Plant of limited distribution or plant about which we need further information
Sonoma Manzanita[1]	*Arctostaphylos canescens ssp. sonomensis*	None	None	Plants rare, threatened, or endangered in California and elsewhere

Table 2. Sensitive Plant Species Potentially Present in the Vicinity of the Horse Mountain Mine and Mill Site *(continued)*

Common Name	Scientific Name	Federal Status	California Status	California Native Plant Society Status
Tracy's Collomia[1,2]	*Collomia tracyi*	None	None	Plant of limited distribution or plant about which more information is needed
Tracy's Sanicle[1]	*Sanicula tracyi*	None	None	Plants of limited distribution—a watch list; plants rare, threatened, or endangered in California, but more common elsewhere
Trailing Black Currant[1]	*Ribes laxiflorum*	None	None	Plants about which more information is needed
Trifoliate Laceflower[1]	*Tiarella trifoliata var. trifoliata*	None	None	Plants about which more information is needed
White-Flowered Rein Orchid[1]	*Piperia candida*	None	None	Plants rare, threatened, or endangered in California and elsewhere
Vollmer's Lily[2]	*Lilium pardalinum ssp. vollmeri*	None	None	Plant of limited distribution or plant about which more information is needed

Notes:

1 = Identified using http://imaps.dfg.ca.gov/viewers/cnddb_quickviewer/app.asp in quadrants surrounding jobsite located at Grouse Mountain Quadrant (Maple Creek, Lord Ellis Summit, Willow Creek).

2 = Identified using http://imaps.dfg.ca.gov/viewers/cnddb_quickviewer/app.asp in Grouse Mountain Quadrant (which includes project site).

ssp = subspecies

var = variety

Table 3. Screening of Analytical Results for Source Material Samples

Sample ID No.	Date Collected	Description	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
HM-TL-2	08/06/07	Tailings from Adit/Pond	**10.5**	<1.0	**4.66**	<0.5	<0.5	**602**	54.1	**7.71**	**11.3**	<0.14	1.15	1,190	<1.0	<0.5	<1.0	**14.9**	**21.7**
HM-TL-3	08/06/07	Tailings from Adit/Pond	**8.80**	<1.0	1.97	<0.5	<0.5	**604**	71.3	**5.26**	**6.10**	<0.14	<1.0	1,360	<1.0	<0.5	<1.0	**13.3**	**15.2**
HM-TL-4	08/07/07	Tailings from Mill	**11.7**	<1.0	**6.79**	<0.5	<0.5	**751**	**89.3**	**1,640**	**6.35**	0.16	<1.0	1,450	<1.0	**0.785**	<1.0	**29.4**	**398**
HM-TL-5	08/07/07	Tailings from Mill	**10.9**	<1.0	**3.07**	<0.5	<0.5	**744**	71.3	**1,800**	<0.5	<0.14	<1.0	1,490	<1.0	<0.5	<1.0	**26.2**	**14.5**
HM-TL-6	08/07/07	Tailings from Mill	**18.4**	<1.0	**17.4**	<0.5	<0.5	**1,180**	**123**	**29.1**	<0.5	<0.14	<1.0	**2,030**	<1.0	<0.5	<1.0	**50.8**	**25.6**
HM-TL-7	08/07/07	Tailings from Mill	**16.4**	<1.0	**14.0**	<0.5	<0.5	**917**	70.9	**314**	**35.9**	<0.14	<1.0	1,300	<1.0	<0.5	<1.0	**36.0**	**16.1**
HM-TL-8	08/07/07	Tailings from Mill	**11.8**	<1.0	**7.00**	<0.5	**1.33**	**918**	54.3	**8,060**	**2.25**	<0.14	<1.0	705	<1.0	**0.725**	**1.20**	**36.5**	**28.2**
HM-TL-9	08/07/07	Tailings from Mill	**18.8**	<1.0	**7.87**	<0.5	<0.5	**1,180**	**96.6**	**103**	<0.5	<0.14	<1.0	**1,630**	<1.0	<0.5	<1.0	**38.2**	**20.1**
HM-TL-10	08/07/07	Tailings from Mill	**8.36**	<1.0	**6.62**	<0.5	<0.5	**787**	52.1	**16,500**	**10.3**	0.27	<1.0	703	<1.0	**1.55**	<1.0	**30.1**	**63.5**
HM-SS-11	08/07/07	Tailings from Mill	**15.8**	<1.0	**18.1**	<0.5	<0.5	**941**	**80.5**	**14,500**	**22.9**	0.16	<1.0	1,050	<1.0	**1.45**	<1.0	**38.4**	**152**
HM-SS-12	08/07/07	Tailings from Adit/Pond	**19.7**	<1.0	**5.38**	<0.5	<0.5	**1,050**	69.8	**30.9**	**23.7**	**0.90**	1.17	1,480	<1.0	**2.36**	<1.0	**27.6**	**29.3**
HM-SS-13	08/07/07	Tailings from Open Pit	**25.2**	<1.0	1.46	<0.5	<0.5	**688**	70.9	**151**	**4,480**	<0.14	<1.0	1,400	<1.0	<0.5	<1.0	**17.2**	9.34
HM-BKSD	08/30/11	Mill Site	**2.9**	**6.6**	**3.5**	<0.38	<0.47	**790**	**89**	**1,600**	**1.4 J**	0.018	<0.24	**1,800**	<0.57	0.24 J	<0.55	**29**	**22**
HM-TL-LOWER	08/30/11	Lower Mill Site	**3.1**	**7.0**	**11**	<0.40	<0.50	**820**	**110**	**2,300**	**11**	0.064	<0.26	**1,700**	0.9 J	0.38 J	0.63 J	**36**	**36**
		Background (Sample HM-SS-1)	9.88	<1	1.98	<0.5	<0.5	556	72.8	4.07	<0.5	0.54	1.73	1,560	<1	<0.5	<1	7.52	11.4
		Retained as COPC	**Yes**	**Yes**	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
Human Health Criteria and COC Determination																			
		BLM Soil RMC for Camper	50[a]	20[a]	NA	NA	70[a]	NA	NA	5,000[a]	1,000[a]	40[a]	NA	2,700[a]	700[a]	NA	NA	NA	40,000[a]
		BLM Soil RMC for ATV Driver	750	300	NA	NA	950	NA	NA	70,000	1,000	550	NA	38,000	9,600	NA	NA	NA	550,000
		EPA RSL for Industrial Worker	410	1.6	190,000[a]	2,000[a]	800[a]	1,500,000[a]	300[a]	41,000	800	310	5,100[a]	20,000	5,100	5,100[a]	10[a]	5,200[a]	310,000
		COC for Human Health?	No	No	No	No	No	No	No	**Yes**	**Yes**	No	No	No	No	No	No	No	No
Ecological Criteria and COC Determination																			
		BLM Soil Ecological Criteria (deer mouse)	NA	230	NA	NA	7	NA	NA	640	142	2[a]	NA	NA	NA	NA	NA	NA	419
		BLM Soil Ecological Criteria (median)	NA	275	NA	NA	3	NA	NA	136	125	8	NA	NA	NA	NA	NA	NA	307
		EPA Eco-SSL (mammalian)	0.27[a]	46	2,000[a]	21[a]	0.36[a]	34	2,100	49	56	NA	NA	130[a]	0.63[a]	14	NA	280	79
		EPA Eco-SSL (avian carnivore)	NA	43[a]	NA	NA	0.77	26[a]	1,300[a]	28[a]	11[a]	NA	NA	210	1.2	4.2[a]	NA	7.8[a]	46[a]
		COC for Ecological Receptors?	**Yes**	No	No	No	**Yes**	**Yes**	No	**Yes**	**Yes**	No	No	**Yes**	No	No	No	**Yes**	**Yes**

Notes: All values listed are in milligrams per kilogram
Bold text indicates concentration exceeds background
Red text indicates concentration exceeds human health criteria
Shaded cells indicate concentration exceeds ecological critieria.

a = Indicates the screening criteria used in the risk evaluation.

< = not detected at concentration less than reporting limit
ATV = all-terrain vehicle
BLM = Bureau of Land Management
COC = chemical of concern
COPC = chemical of potential concern
Eco-SSL = ecological soil screening level
EPA = U.S. Environmental Protection Agency
J = estimated value
NA = not analyzed/not available
RMC = risk management criteria
RSL = Regional Screening Level

Table 4. Screening of Analytical Results for Sediment Samples

Sample ID No.	Date Collected	Description	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
HM-SD-15	08/07/07	Horse Mountain Creek	**13.5**	<1.0	**5.07**	<0.5	<0.5	**844**	**51.7**	27.3	<0.5	<0.14	<1.0	**1,210**	<1.0	<0.5	<1.0	**41.4**	**11.5**
HM-SD-16	08/07/07	Unnamed Creek	**11.7**	<1.0	**6.69**	<0.5	<0.5	**732**	**50.1**	**57.6**	<0.5	<0.14	<1.0	**1,140**	<1.0	<0.5	<1.0	**31.4**	**14.2**
HM-SD-17	08/07/07	Unnamed Creek	**13.4**	<1.0	**5.77**	<0.5	<0.5	**789**	**55.6**	**108**	<0.5	<0.14	<1.0	1,000	<1.0	<0.5	<1.0	**38.8**	**10.8**
HM-SD-18	08/07/07	Unnamed Creek	**10.7**	<1.0	4.10	<0.5	<0.5	**603**	42.6	**116**	<0.5	<0.14	<1.0	766	<1.0	<0.5	<1.0	**23.8**	**9.72**
		Background (Sample HM-SD-14)	8.78	<1.0	4.17	<0.5	<0.5	577	45.7	41.4	<0.5	<0.14	<1.0	1,080	<1.0	<0.5	<1.0	20.8	9.48
		Retained as COPC	**Yes**	No	**Yes**	No	No	**Yes**	**Yes**	**Yes**	No	No	No	**Yes**	No	No	No	**Yes**	**Yes**
Human Health Criteria and COC Determination																			
		BLM Sediment RMC for Camper	62[a]	46[a]	NA	NA	155[a]	NA	NA	5,745[a]	1,000[a]	46[a]	NA	3,094[a]	774[a]	774[a]	NA	NA	46,455[a]
		BLM Soil RMC for ATV Driver[a]	750	300	NA	NA	950	NA	NA	70,000	1,000	550	NA	38,000	9,600	NA	NA	NA	550,000
		EPA Region IX RSL for Industrial Worker	410	1.6	190,000[a]	2,000[a]	800[a]	1,500,000[a]	300[a]	41,000	800	310	5,100[a]	20,000	5,100	5,100[a]	10[a]	5,200[a]	310,000
		COC for Human Health?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Ecological Criteria and COC Determination																			
		FDEP PEL Sediment Screening Benchmark	NA	41.6	NA	NA	4.21	160	NA	108	112	0.696	NA	42.8	NA	NA	NA	NA	459
		Freshwater Sediment TEC	NA	9.79	NA	NA	0.99	43.4	NA	31.6	35.8	0.18	NA	22.7	NA	NA	NA	NA	121
		FDEP TEL Sediment Screening Benchmark	NA	7.24	NA	NA	0.676	52.3	NA	18.7	30.2	0.13	NA	15.9	NA	0.733[a]	NA	NA	124
		Freshwater Sediment PEC	NA	33[a]	NA	NA	4.98[a]	111[a]	NA	149[a]	128[a]	1.06[a]	NA	48.6[a]	NA	NA	NA	NA	459[a]
		COC for Ecological Receptors?	No	No	No	No	No	**Yes**	No	No	No	No	No	**Yes**	No	No	No	No	No

Notes: All values listed in milligrams per kilogram

Bold text indicates concentration exceeds background

Shaded cells indicate concentration exceeds ecological critieria.

a = Indicates the screening criteria used in the risk evaluation.

b = BLM sediment criteria for the ATV Driver scenario are not available. The BLM soil criteria are therefore used to evaluate sediment.

< = not detected at concentration less than reporting limit

ATV = all-terrain vehicle

BLM = Bureau of Land Management

COC = chemical of concern

COPC = chemical of potential concern

FDEP = Florida Department of Environmental Protection

NA = not analyzed/not available

PEC = probable effects concentration

PEL = probable effects level

RMC = risk management criteria

RSL = Regional Screening Level

TEC = threshold effects concentration

TEL = threshold effects level

Table 5. Screening of Analytical Results for Water Samples

Sample ID No.	Date Collected	Description	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
HM-SW-3	8/7/2007	Pond	<20	6	**10**	<5	<5	<10	<5	<10	<5	<0.4	<10	<20	<10	<5	<5	<5	**29**
HM-SW-4	8/7/2007	Mill Site	<20	<5	<10	<5	<5	**15**	<5	<10	<5	<0.4	<10	**45**	<10	<5	<5	<5	**32**
HM-SW-5	8/7/2007	Horse Mountain Creek	<20	<5	<10	<5	<5	10	<5	<10	<5	<0.4	<10	21	<10	<5	<5	<5	23
		Background (Sample HM-SW-1)	37	9	<10	<5	<5	<10	<5	<10	<5	<0.4	<10	22	<10	<5	<5	<5	22
		Background (Sample HM-SW-2)	<20	<5	<10	<5	<5	12	<5	<10	<5	<0.4	<10	32	<10	<5	<5	<5	26
		Retained as COPC	No	No	**Yes**	No	No	**Yes**	No	No	No	No	No	**Yes**	No	No	No	No	**Yes**
Human Health Criteria and COC Determination																			
		BLM Surface Water RMC for Camper	124[a]	93[a]	NA	NA	155[a]	NA	NA	11,490[a]	50[a]	93[a]	NA	6,194[a]	1,548[a]	1,548[a]	NA	NA	92,909[a]
		EPA Drinking Water MCL	6	10	2,000[a]	4[a]	5	100[a]	NA	1,300	15	2	NA	100	50	NA	2[a]	NA	NA
		EPA RSL for Tap Water	6	0.045	2,900	16	6.9	16,000	4.7[a]	620	NA	4.3	7.8[a]	300	78	71	0.16	78[a]	4,700
		COC for Human Health?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Ecological Criteria and COC Determination																			
		EPA Criteria for Freshwater Aquatic Life Protection (Acute Exposure)	NA	340	NA	NA	2.0	570	NA	13	65	1.4	NA	470	NA	3.2[a]	NA	NA	120
		EPA Criteria for Freshwater Aquatic Life Protection (Chronic Exposure)	NA	150[a]	NA	NA	0.25[a]	74[a]	NA	9[a]	2.5[a]	0.77[a]	NA	52[a]	5[a]	NA	NA	NA	120[a]
		COC for Ecological Receptors?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Notes: All values listed in micrograms per liter

Bold text indicates concentration exceeds background

a = Indicates the screening criteria used in the risk evaluation.

< = not detected at concentration less than reporting limit

BLM = Bureau of Land Management

COC = chemical of concern

COPC = chemical of potential concern

EPA = U.S. Environmental Protection Agency

MCL = maximum contaminant level

NA = not available

RMC = risk management criteria

RSL = regional screening level

Table 6. Preliminary Cleanup Levels[a]

Source	Antimony	Cadmium	Chromium	Copper	Lead	Nickel	Vanadium	Zinc
EPA Eco-SSL (mammalian)	0.27[b]	0.36[b]	34	49	56	130[b]	280	79
EPA Eco-SSL (avian carnivore)	NA	0.77	26[b]	28[b]	11[b]	210	7.8[b]	46[b]
Site Background (Sample HM-SS-1)	9.88	<0.5	556	4.07	<0.5	1,560	7.52	11.4
Regional Background (Sample GC077150)[c]	<1	NA	200	50	15	50	200	113
Regional Background (Sample GC077250)[c]	<1	NA	300	30	20	50	150	56
Regional Background (Sample GC260150)[c]	NA	NA	150	100	20	50	150	80
Average Background	3.96	0.5	301.5	46	13.8	428	126.8	260

Notes: All values listed in milligrams per kilogram

a = Because only site-specific background value is available, these preliminary cleanup levels include regional background values. Regional and site background values should be evaluated further prior to selecting the final cleanup goals.

b = Indicates the most conservative screening level used in the risk evaluation for both human and ecological receptors

c = U.S. Geological Survey, 2001. "Geochemical Landscapes of the Conterminous United States - New Map Presentations for 22 Elements." *Professional Paper 1648.* November. Raw data provide by the author (i.e., N. Gustavsson et al.).

Eco-SSL = ecological soil screening level

EPA = U.S. Environmental Protection Agency

NA = not available

Table 7. Federal Chemical-Specific ARARs

Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Clean Water Act of 1977, as Amended [a]				
Surface water quality standards	Discharges to waters of the United States	40 CFR § 131.38	Applicable	These standards, known as the CTR, are applicable surface water ARARs. Any discharges to site surface waters would comply with this ARAR.
Establishes ambient water quality criteria as water quality standards	Potential drinking water or surface water with beneficial uses that include protection of aquatic life	Nonpromulgated guidance developed by EPA as required by § 304(a)of the Clean Water Act	To be considered	Ambient water quality criteria are nonenforceable guidance developed by EPA and used to establish water quality standards. Generally, ambient water quality criteria are considered potentially relevant and appropriate for surface water considered a potential drinking water source in the absence of promulgated MCLs. However, if the surface water's designated beneficial use includes protection of aquatic life, the ambient water quality criterion may be more stringent than the MCL.
Safe Drinking Water Act				
National Primary Drinking Water Regulations MCLs	Establishes health-based MCLs for public water systems and sets goals for contaminants	40 CFR § 141	Relevant and Appropriate	Surface water downstream from the site is used as drinking water; however, no contaminant levels have been detected at concentrations exceeding applicable MCLs at the site. MCLs are relevant and appropriate for any action at the site to ensure protection of downstream surface water intakes.
Bevill Amendment § 3001(a)(3)(A)(ii), 42 USC, § 6921(a)(3)(A)(ii) a				
Excludes from hazardous waste classification solid waste from the extraction, beneficiation, and processing of ores and minerals	Mining waste from extraction is exempt from Subtitle C of RCRA	40 CFR §261.4(b)(7)	Applicable	Mine waste piles at the site are from the extraction of minerals; therefore, they do not warrant regulation as hazardous waste and are not subject to RCRA Subtitle C regulation.

Table 7. Federal Chemical-Specific ARARs *(continued)*

Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
EPA Eco-SSLs [a]				
Provides nonregulatory screening criteria for the protection of ecological receptors.	Soil and source material	Nonpromulgated guidance developed by EPA Office of Solid Waste and Emergency Response Directive 9285.7	To be considered	The (non-site-specific) Eco-SSLs are appropriate as screening tools and initial cleanup goals if applicable.
Risk Management Criteria for Metals at BLM Mining Sites				
Provides nonregulatory risk management criteria for human health and wildlife, which include numerical action levels for metals in environmental media. Criteria are derived using EPA-acceptable levels of risk and standard exposure assumptions.	Soil and source material	BLM, 2004. "Risk Management Criteria for Metals at BLM Mining Sites (Technical note 390)" and BLM, 1998, "Interim Revision of Wildlife Management Criteria"	To be considered	Non-site-specific risk management criteria for metals at mining sites; criteria have been developed for human (camper, ATV driver, and worker), livestock, and wildlife. These values are appropriate as site screening tools and initial cleanup goals, if applicable.
EPA Regional Screening Levels				
Provides nonregulatory screening criteria for the protection of human health.	Soil and source material	Nonpromulgated guidance developed by the EPA Superfund Program of the Pacific Southwest (Region 9)	To be considered	The (non-site-specific) RSLs are appropriate as site screening tools and initial cleanup goals if applicable.

Table 7. Federal Chemical-Specific ARARs *(continued)*

Notes:

a = Statutes and policies are provided as headings to identify general categories of potential ARARs; only pertinent substantive requirements of the specific citations are considered potential ARARs.

b = Naturally occurring asbestos and asbestos in soil are not specifically regulated by the federal government. No cleanup levels or screening criteria are promulgated for asbestos. Guidance document available online at: <http://epa.gov/superfund/health/contaminants/asbestos/pdfs/framework_asbestos_guidance.pdf>.

ARAR = applicable or relevant and appropriate requirement

ATV = all-terrain vehicle

BLM = Bureau of Land Management

CFR = Code of Federal Regulations

Eco-SSL = ecological soil screening levels

EPA = U.S. Environmental Protection Agency

MCLs = maximum contaminant levels

RCRA = Resource Conservation and Recovery Act

USC = United States Code

§ =Section

Table 8. State Chemical-Specific ARARs

Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
California's Health and Safety Code[a]				
California's Health and Safety Code recognizes the Bevill Amendment exclusion, so that wastes that would otherwise be regulated by the California Hazardous Waste Control Law, the California-equivalent to RCRA, are instead subject only to the requirements of the California Water Code § 13172, detailed in Title 27 CCR § 22470.	Wastes from the extraction, beneficiation, and processing of ores and minerals that Bevill exempt	Health and Safety Code § 25143.1(b)(1&2)	Applicable	Mine waste piles at the site are from the extraction of minerals; therefore, they do not warrant regulation as hazardous waste.
State and Regional Water Quality Control Boards[a]				
Authorizes SWRCB and RWQCB to establish in water quality control plans, beneficial uses and numerical and narrative standards to protect both surface water and groundwater quality.	Waters of the state	California Water Code, Division 7, §§ 13241, 13243, 13263(a), 13269, and 13360	Applicable	The substantive provisions of these sections of the California Water Code are applicable, as implemented through the beneficial uses and water quality objectives of the North Coast RWQCB's water quality control plans.
Specifies that all surface and groundwaters of the State are considered suitable, or potentially suitable, for municipal or domestic water supply with the following exceptions: (1) those water bodies with yields below 200 gallons per day, (2) total dissolved solids exceeding 3,000 mg/L, or (3) contamination that cannot reasonably be treated for domestic use by either best management practices or best economically achievable treatment practices.	Waters of the state	SWRCB Resolution 88-63	Relevant and appropriate	This is applicable to surface water at the site. This resolution would be an ARAR for any discharges to surface water during the removal action.

Table 8. State Chemical-Specific ARARs *(continued)*

Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
State and Regional Water Quality Control Boards[a]				
Establishes a policy that waters of the state shall be maintained to the maximum extent possible, and sets forth waste discharge requirements to protect waterways.	Waters of the state	SWQCB Resolution 68-16	Applicable	Statement of Policy With Respect to Maintaining High Quality Waters in California, establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the state." It requires the maintenance of high-quality waters until it has been demonstrated that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect beneficial uses of such water, and will comply with applicable water quality control policies. It further requires that any discharge of waste to high quality waters complies with requirements resulting in best practicable treatment or control to prevent pollution or nuisance.

Notes:

a = Statutes and policies are provided as headings to identify general categories of potential ARARs; only pertinent substantive requirements of the specific citations are considered potential ARARs.

ARAR = applicable or relevant and appropriate requirement

CCR = California Code of Regulations

RCRA = Resource and Conservation Recovery Act

RWQCB = Regional Water Quality Control Board

SWRCB = State Water Resources Control Board

§ = Section

Table 9. Federal Location-Specific ARARs

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Endangered Species Act of 1973[a]					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat.	Determination of effect upon endangered or threatened species or its habitat; critical habitat upon which endangered species or threatened species depend	16 USC § 1536(a),(h)(1)(B)	Applicable	The Site contains habitat of several federally listed species (see Table 1 of EE/CA). Prior to any removal action, a biological evaluation may be required to determine the potential for adverse effects or harm to any listed species or the destruction or adverse modification of in-stream aquatic habitats along and downstream of the section of the unnamed tributary and Horse Mountain Creek within the site.
Migratory Bird Treaty Act of 1972[a]					
Migratory bird area	Protects almost all species of native migratory birds in the US from unregulated "take."	Presence of migratory birds	16 USC § 703	Relevant and appropriate	To date, no migratory birds have been identified at the site. Compliance with this act will be required if migratory birds are identified.
Executive Order No. 11988, Floodplain Management[a]					
Floodplain area	Actions taken should avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values.	Action that will occur in a floodplain and relatively flat areas adjoining inland and coastal waters and other flood-prone areas	40 CFR § 6.302(b)	Applicable	Floodplain management actions must be incorporated in the proposed removal action work plan, since work will be conducted along an unnamed tributary to Horse Mountain Creek, including floodplain areas.

Table 9. Federal Location-Specific ARARs *(continued)*

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Magnuson-Stevens Fishery Conservation and Management Act of 1976, as Amended[a]					
Fishery under management	Provides for conservation and management of specified fisheries within specified fishery conservation zones.	Presence of managed fisheries	16 USC §§ 1801–1882	Relevant and appropriate	Site actions will evaluate potential adverse effects or harm to managed fisheries downstream from the site. To date, surface water at the site has not been identified as a medium of concern.
National Historic Preservation Act of 1966, as Amended[a]					
Federal land	Establishes a program for the preservation of historic federal properties within the U.S.	Property included in or eligible for the National Register of Historic Places	16 USC § 470–470x-6 36 CFR 800 40 CFR § 6.301(b)	Not an ARAR	Remaining structures within the boundary of the Horse Mountain Mine and Mill Site are not classified as being of historic importance according to available records and the site is not on the National Register of Historic Places.
Archaeological and Historic Preservation Act[a]					
Federal land	Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	Federal construction project or federally licensed activity or program	16 USC § 469–469(c)(1) 40 CFR § 6.301(c)	Relevant and appropriate	To date, no historical or archaeological resources have been identified at the Site. Compliance with this act will be required if archaeological resources are identified. If any removal action would cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archaeological data, it will be necessary to follow the procedures in the statute to provide for data recovery and preservation activities.

Table 9. Federal Location-Specific ARARs *(continued)*

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Archaeological Resources Protection Act of 1979, as Amended[a]					
Public lands	Prohibits unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources located on public lands unless such action is conducted pursuant to a permit.	Archaeological resources on federal land	Public Law No. 96-95 16 USC § 470aa–470mm	Relevant and appropriate	To date, no archaeological resources have been identified at the Site. Compliance with this act will be required if archaeological resources are identified. If any removal action would cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archaeological data, it will be necessary to follow the procedures in the statute to provide for data recovery and preservation activities.
Protection Wetlands Executive Order					
Protection of Wetlands Executive Order No 11990	Protects against adverse impacts associated with the destruction or loss of wetlands and against new construction in wetlands if a practicable alternative exists.	Wetland present on site	Executive Order No. 11990	Relevant and appropriate	Although not a designated wetland, the area where the impoundment ponds are located is likely a former wetland area. The removal action design and work plan must ensure that this area remains a low-lying area where water may pond naturally and support wetland conditions.

Table 9. Federal Location-Specific ARARs *(continued)*

Location	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Special Interest Areas					
Horse Mountain Botanical Area, an SIA	Requires that areas of special interest are maintained principally for recreational use substantially in their natural condition.	Land designated as an SIA	36 CFR 294.1	Applicable	The Forest Service has established the Horse Mountain Botanical Area as an SIA, classified in the Forest Service's SIA Management Strategy "for protection of unique botanical values, for educational purposes, and for recreational use compatible with these values." Any action taken in the area must comply with the requirements of the Forest Service's SIA Management Strategy.
Six Rivers National Forest Land and Resource Management Plan – Port-Orford-Cedar Action Plan					
Six Rivers National Forest, Uninfected Port-Orford-cedar Habitat	Requires that plans be drawn up and implemented to protect Port-Orford-cedars from exposure to root disease.	Site is located in an area with uninfected Port-Orford-cedar population	Forest Plan, Appendix K. Port-Orford-cedar Action Plan	To Be Considered	Any action taken in the area has the potential to expose uninfected trees to root disease. Disease control strategies listed in Appendix K must be incorporated into any action at the site.

Notes:

a = Statutes and policies are provided as headings to identify general categories of potential ARARs; only pertinent substantive requirements of the specific citations are considered potential ARARs.

ARAR = applicable or relevant and appropriate requirement

CFR = Code of Federal Regulations

EE/CA = engineering evaluation/cost analysis

SIA = Special Interest Area

USC = United States Code

§ = Section

Table 10. Federal Action-Specific ARARs

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Clean Water Act, as Amended[a]					
Construction activities	Establishes the structure for regulating discharges of pollutants to waters of the United States and regulating quality standards for surface waters; establishes limitations, standards, and other permit conditions. SWRCB Order 99-08-DWQ, developed pursuant to these requirements sets forth requirements for all construction activity in the State of California (except for Tribal Lands, the Lake Tahoe Hydrologic Unit, and activity performed by the California Department of Transportation)	Construction activities at least 1 acre in size	Clean Water Act 33 USC §1251 et seq. (1972) 40 CFR § 122.44(k)(2) and (4) (SWRCB Order 99-08-DWQ was adopted pursuant to this section)	Applicable	Applicable to all construction activities. For alternatives that will disturb more than 1 acre, compliance with the following substantive requirements of the State's General Permit (99-08-DWQ) is required: ▪ Develop and implement a Stormwater Pollution Prevention Plan specifying BMPs to protect stormwater ▪ Establish measures to eliminate non-storm discharges ▪ Specify BMP inspection requirements
Fish and Wildlife Coordination Act[a]					
Controls or structural modifications of a natural stream	Enacted to protect fish and wildlife when federal actions result in the control or structural modification of a natural stream or body of water. Requires federal agencies to take into consideration the effect that water-related projects would have on fish and wildlife and then take action to prevent loss or damage to those resources.	Action that occurs within a stream or body of water	16 USC § 661	Applicable	This act applies to any alternative that requires diverting the unnamed tributary and includes restoration of the creek bed.

Table 10. Federal Action-Specific ARARs *(continued)*

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Native American Graves Protection and Repatriation Act					
Excavation and ground disturbance	Requires that Native American graves not be disturbed and that, if discovered, excavation and ground disturbance will be stopped.	Excavation and ground-disturbing activities	25 USC§3001 et seq. 43 CFR Part 10	Relevant and appropriate	Protects Native American graves from desecration through the removal and trafficking of human remains and cultural items, including funerary and sacred objects. To protect Native American burials and cultural items, the regulations require that, if such items are inadvertently discovered during excavation, the excavation must cease and the affiliated tribes must be notified and consulted. Applies to ground-disturbing activities such as soil grading and removal.
American Indian Religious Freedom Act					
Excavation and ground disturbance	Protects traditional religious rights and cultural practices of Native Americans, including access of sacred sites, freedom to worship through ceremonial and traditional rights, and use and possession of objects considered sacred.	Excavation and ground-disturbing activities	42 USC§1996 et seq.	Relevant and appropriate	This act requires that excavation and soil grading have no negative impact on the free practice of religion by Native American groups. If sacred sites are discovered in the course of soil disturbances, work will be stopped and appropriate notifications made.

Table 10. Federal Action-Specific ARARs *(continued)*

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Framework for Investigating Asbestos-Contaminated Superfund Sites					
Establishes procedures for the evaluation of sites contaminated by asbestos	Potentially contaminated soil or asbestos source material	Excavation and ground-disturbing activities	Nonpromulgated guidance developed in EPA's 2008 "Framework for Investigating Asbestos-Contaminated Superfund Sites"	To be considered	Establishes procedures for collecting activity-based samples during the evaluation of sites contaminated by asbestos.

Notes:

a = Statutes and policies are provided as headings to identify general categories of potential ARARs; only pertinent substantive requirements of the specific citations are considered potential ARARs.

ARAR = applicable or relevant and appropriate requirement

BMPs = best management practices

CFR = Code of Federal Regulations

EPA = U.S. Environmental Protection Agency

SWRCB = State Water Resources Control Board

TBC = to be considered

USC = United States Code

§ = Section

Table 11. State Action-Specific ARARs

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments and Compliance Measures
North Coast Regional Water Quality Control Board Draft Basin Plan Amendment [a]					
Earth-disturbing construction activities	Proposed Basin Plan amendment that prohibits the discharge of excess sediment. This amendment is necessary to comply with 23 CCR § 2915.	Anthropogenic activities that could result in a discharge of excess sediment	Draft Measures to Reduce Excess Sediment, SWRCB, July 18, 2007	To be considered	To be considered in the development of design documents for the selected removal action.
California Mining Waste Regulations Pursuant to California Water Code § 13172 [a]					
Onsite encapsulation of mining waste	Addresses the management of mining waste. The regulations contain specific requirements on siting, construction, monitoring, and closure and post-closure maintenance of existing and new units.	Mining waste	27 CCR §§ 22470–22510	Relevant and appropriate	The regulations establish the following three groups of mining waste. Group A – mining waste that must be managed as hazardous waste provided the RWQCB finds that such mining wastes pose a significant threat to water quality. Group B – mining wastes that consist of or contain hazardous wastes that qualify for a variance, provided that the RWQCB finds that such mining wastes pose a low risk to water quality, or mining wastes that consist of or contain nonhazardous soluble pollutants at concentrations that exceed water quality objectives for, or could cause, degradation of waters of the state. Group C – wastes from which any discharge would be in compliance with the applicable water quality control plan, including water quality objectives other than turbidity.

Table 11. State Action-Specific ARARs *(continued)*

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments and Compliance Measures
California Mining Waste Regulations Pursuant to California Water Code § 13172 [a] *(continued)*					
Onsite encapsulation of mining waste	The State of California has adopted regulations designed to address the management of mining waste. The regulations contain specific requirements on siting, construction, monitoring, and closure and post-closure maintenance of existing and new units.	Mining waste	27 CCR §§ 22470–22510	Relevant and appropriate	Classification of the mining waste as hazardous under the Hazardous Waste Control Act is used to determine which group designation is appropriate. Mining wastes at the site may be classified as either Group B or Group C wastes, depending on hazardous characteristics and the level of threat to water quality. These requirements are ARARs for alternatives that involve the creation of an onsite encapsulation unit.
California Air Resources Board, Asbestos Airborne Toxic Control Measure for Construction, Grading Quarrying and Surface Mining Operations					
Construction and grading	Stabilization and monitoring must be conducted when ultramafic or serpentinite soils are disturbed by construction or grading activities.	Disturbing ultramafic or serpentinite soil	CCR Title 17, § 93105	Applicable	Applies to construction activities that disturb serpentinite soil at the site known to contain asbestos. Wetting or other stabilization is required, as well as adequate air monitoring and personal protective equipment.
North Coast Unified Air Quality Management District					
Excavation and handling of contaminated soil	Prohibits discharge of hazardous materials to air via fugitive dust, and adopts the NESHAP.	Disturbing Contaminated soil	Rule 104 Prohibitions	To Be Considered	Nonpromulgated rule that prohibits the discharge of material that causes injury, detriment, or nuisance to the public. Prohibits unnecessary amounts of particulate matter from becoming airborne and requires that reasonable precautions be taken to prevent particulate matter from becoming airborne.

Table 11. State Action-Specific ARARs *(continued)*

Notes:

a = Statutes and policies are provided as headings to identify general categories of potential ARARs; only pertinent substantive requirements of the specific citations are considered potential ARARs.

ARAR = applicable or relevant and appropriate requirement

CCR = California Code of Regulations

NESHAP = National Emission Standards for Hazardous Air Pollutants

RWQCB = Regional Water Quality Control Board

SWRCB = State Water Resources Control Board

§ = Section

Table 12. Summary of Response Action Screening

Response Action	Technology and Process	Description	Screening Summary
1. No Action	None	None	Retained; required by CERCLA
2. Engineering Controls	▪ Soil cap ▪ Durable covers (i.e., asphalt paving)	▪ Excavate source material for placement in onsite encapsulation unit ▪ Construct soil cap over encapsulation unit ▪ Construct asphalt cap over encapsulation unit	Retained because: ▪ Protective of human health and the environment and meets RAOs ▪ Effective, easily implementable ▪ Reduces future risk of erosion into creek
3. Offsite Disposal	▪ Remove source materials for disposal off site	▪ Excavate source materials ▪ Load soil into dump trucks and transport to an offsite disposal facility	Retained because: ▪ Protective of human health and the environment and meets RAOs ▪ Effective, easily implementable ▪ Eliminates future risk of erosion into creek

Notes:

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

RAO = remedial action objectives

Table 13. Comparative Analysis of Removal Action Alternatives

Evaluation Criteria	Alternative 1 No Action	Alternative 2A Excavation and Onsite Encapsulation of Source Materials (One Encapsulation Unit, Soil Cover)	Alternative 2B Excavation and Onsite Encapsulation of Source Materials (One Encapsulation Unit, Asphalt Cover)	Alternative 3A Excavation and Onsite Encapsulation of Source Materials (Two Encapsulation Units, Soil Cover)	Alternative 3B Excavation and Onsite Encapsulation of Source Materials (Two Encapsulation Units, Asphalt Cover)	Alternative 4 Excavation and Off-Site Disposal of Source Materials
Effectiveness	**Qualitative Ranking**					
Protection of Human Health and Environment	No	Yes	Yes	Yes	Yes	Yes
Compliance with ARARs	NA	Yes	Yes	Yes	Yes	Yes
Long-Term Effectiveness	Low	Moderate	Moderate	Moderate	Moderate	High
Short-Term Effectiveness	Low	High	High	High	High	High
Achieve RAOs	No	Yes	Yes	Yes	Yes	Yes
Reduction of Toxicity, Mobility, and Volume through Treatment	Low	Low	Low	Low	Low	Low
Implementability	**Qualitative Ranking**					
Technical Feasibility	High	High	High	High	High	High[1]
Administrative Feasibility	High	High	High	High	High	High
Availability of Services or Materials	NA	High	High	High	High	Moderate

Table 13. Comparative Analysis of Removal Action Alternatives *(continued)*

Evaluation Criteria	Alternative 1 No Action	Alternative 2A Excavation and Onsite Encapsulation of Source Materials (One Encapsulation Unit, Soil Cover)	Alternative 2B Excavation and Onsite Encapsulation of Source Materials (One Encapsulation Unit, Asphalt Cover)	Alternative 3A Excavation and Onsite Encapsulation of Source Materials (Two Encapsulation Units, Soil Cover)	Alternative 3B Excavation and Onsite Encapsulation of Source Materials (Two Encapsulation Units, Asphalt Cover)	Alternative 4 Excavation and Off-Site Disposal of Source Materials
Cost						
Period of Analysis (Years)	30	30	30	30	30	30
Estimated Capital Cost	$0	$1,476,288	$1,670,760	$1,362,203	$1,649,528	$7,907,914
Estimated Annual O&M/Periodic Cost	$0	$501,600/$234,000	$547,200/$256,500	$570,000/$279,000	$615,600/$312,000	$11,400 /$0
Estimated Total Cost	$0	$2,211,888	$2,474,460	$2,211,203	$2,577,128	$7,919,090
Estimated Total Present Value of Alternative	$0	$2,017,535	$2,261,923	$1,986,260	$2,330,978	$7,919,090
EE/CA Range (-30% / +50%)	$0	$1,412,275 to $3,026,303	$1,583,346 to $3,392,884	$1,390,382 to $2,979,390	$1,631,685 to $3,496,467	$5,543,363 to $11,878,636

Notes:

1 = Alternative 4 would likely need to be performed during two construction seasons.

ARARs = applicable or relevant and appropriate requirements

EE/CA = Engineering Evaluation/Cost Analysis

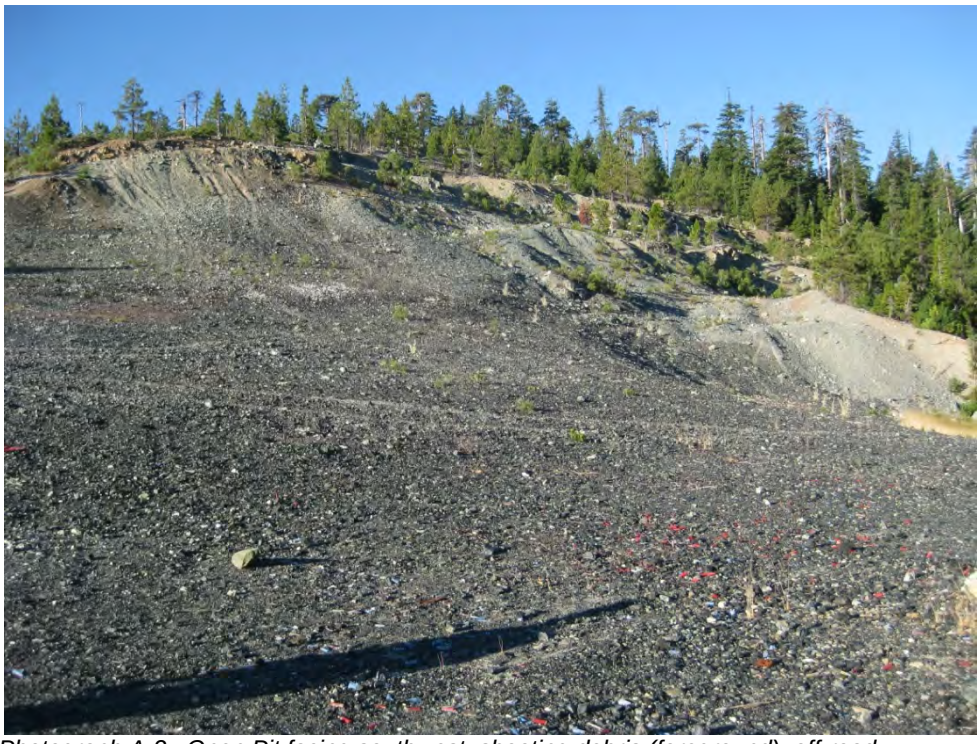
NA = not applicable

O&M = Operation and Maintenance

RAO = removal action objective

Appendix A. Photographic Log

Photograph A-1: Overview of the Open Pit, facing south.
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012



Photograph A-2: Open Pit facing southwest, shooting debris (foreground), off-road vehicle tracks (background), facing south
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-3: Overview of the Open Pit facing south–southeast.
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-4: View of the Open Pit facing west.
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-5: View of the Open Pit from above, showing terraces and access road on the left, facing northeast.

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-6: View of the Open Pit from above, from highest terrace level, facing northeast

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-7: View of the floor of Open Pit and main access road, facing north
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-8: Overview of the Open Pit floor, main access road, and platform of waste rock on north side of road, facing northeast.
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-9: Open Pit terraces exposing in-situ serpentinite, facing south.
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-10: Waste pile north of Open Pit, facing west
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-11: Waste rock piles north of Open Pit and access road, facing east
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-12: Closeup of waste rock material in pile north of Open Pit, facing down
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-13: Shooting area in eastern portion of Open Pit, facing northwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-14: Closeup of shooting debris at Open Pit shooting area, facing north
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-15: Shooting area in Open Pit (foreground) with berm (background), facing east

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-16: Shipping container with bullet holes at shooting area east of Open Pit, facing west

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-17: Overview of Open Pit from Horse Mountain communication tower area, facing south.

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

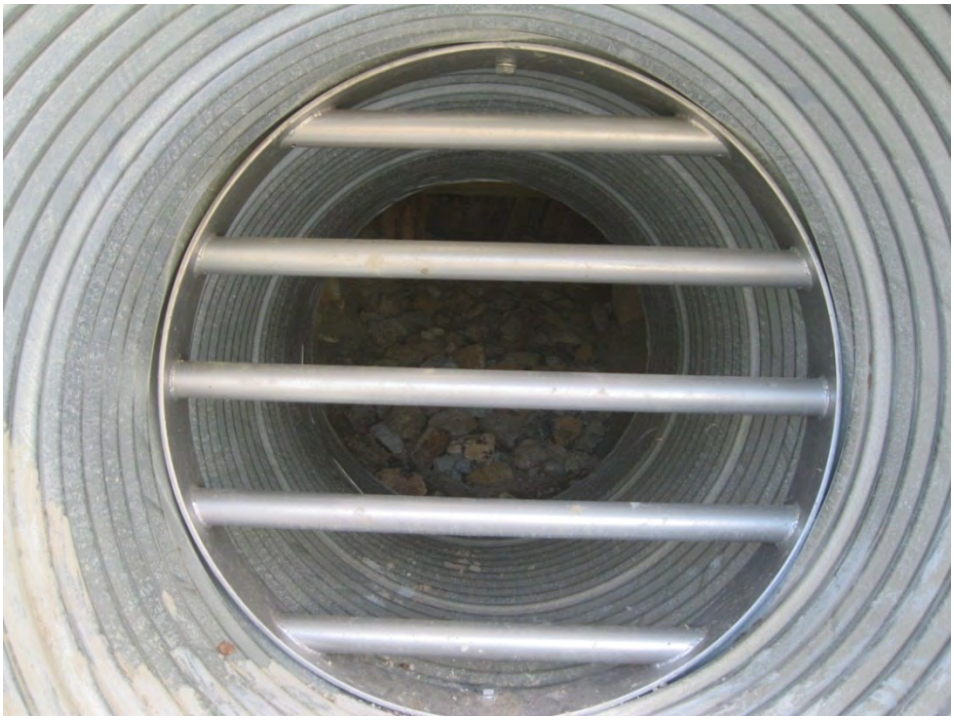
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-18: Adit opening southwest of impoundment ponds at Adit/Pond Area prior to safety closure, facing west

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-19: Adit opening southwest of impoundment ponds at Adit/Pond area after safety closure, facing south.
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012



Photograph A-20: Closeup of adit interior after safety closure, facing southwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-21: Former dam/creek diversion in unnamed tributary upstream of adit in Adit/Pond Area, facing west

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-22: Southern impoundment pond and waste materials (berms) at Adit/Pond Area, facing south

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-23: Northern impoundment pond and waste materials (berms) at Adit/Pond Area, facing south
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-24: Drainage from Adit into impoundment ponds facing northeast
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-25: Impoundment ponds and waste materials (berms), facing north
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-26: impoundment ponds and waste materials (berms), showing drainage to unnamed tributary (foreground), facing north
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-27: Culvert diversion of the unnamed tributary on north side of main access road, beneath waste pile associated with Adit/Pond Area (foreground), facing southeast
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-28: Waste pile associated with Adit/Pond Area, showing mining debris (wooden timbers), facing northwest

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-29: Mining debris (steel-lined wooden bin) associated with Adit/Pond Area, facing northeast

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-30: Overview of north side of waste pile associated with Adit/Pond area; mining debris mixed into waste pile, facing southwest.

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-31: Waste pile associated with Adit/Pond Area, sloping steeply down to unnamed tributary (upper right) where waste is in contact with creek bed, facing north
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-32: Closeup of waste pile associated with Adit/Pond Area (background) in direct contact with creek bed of unnamed tributary (foreground), facing south
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-33: Overview of south end of waste pile associated with Adit/Pond Area (main access road at right), facing southeast

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-34: Southern end of waste pile associated with Adit/Pond Area, looking towards the road, facing west.

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-35: Overview of waste pile associated with Adit/Pond Area (through trees in foreground) and impoundment ponds (across road in background), facing southwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-36: Partially collapsed adit opening between Open Pit and Adit/Pond Area prior to safety closure, facing south (no obvious waste pile was associated with this adit)
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-37: Partially collapsed adit opening between Open Pit and Adit/Pond Area after safety closure, facing south

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-38: Mill Site overview showing terraced former mill building concrete foundations (outlined), facing southeast

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-39: Mill Site overview with former mill building concrete foundations in background, facing northeast

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-40: Road crossing Mill Site, between concrete foundations, facing east
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-41: Former mill building concrete foundations, debris (steel, wood), and source materials (waste rock and tailings), facing west
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-42: Former mill building concrete foundations, facing southwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-43: Overview of former mill area from upslope. Concrete channel (foreground) above former mill building foundations, facing northeast
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-44: Closeup of concrete channel above former mill building foundations; waste rock pile (background), facing southwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-45: Mill Site shooting area with abandoned vehicle, facing northeast
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-46: Mill Site shooting area and waste piles with abandoned vehicle, facing southwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-47: Mill Site shooting area and waste piles with abandoned vehicle, facing south
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-48: Closeup of shooting debris at Mill Site, facing down.
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-49: Former mill building concrete foundations (foreground) and waste rock (background), facing south
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-50: Closeup of former mill building concrete foundations, facing northeast
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-51: Closeup of wood debris within former mill building foundations, facing northeast

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-52: Metal and wood debris inside sump within former mill building foundations, facing down

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-53: Tailings (black sand) on former mill building foundations at north end of foundations, facing southeast

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-54: Tailings (black sand) on former mill building foundations at north end of foundations, facing southeast

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph A-55: Closeup of tailings (black sand) on mill building foundations at north end of foundation, facing down

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-56: Tailings downslope and north of former mill building foundations
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-57: Concrete foundations containing tailings downslope and north of former mill building, facing southeast
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Photograph A-58: Closeup of tailings (fine dust) within concrete foundations north of former mill building, facing down

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Caitlin Gorman (ERRG) Date: August 30, 2011

Appendix B. Analytical Data

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Pleasanton
1220 Quarry Lane
Pleasanton, CA 94566
Tel: (925)484-1919

TestAmerica Job ID: 720-37282-1
Client Project/Site: Horse Mountain
Revision: 1

For:
Engineering Remediation Resources Group.
115 Sansome Street
Suite 200
San Francisco, California 94104

Attn: Ms. Caitlin Gorman

Authorized for release by:
2/11/2013 2:39:17 PM

Dimple Sharma
Project Manager I
dimple.sharma@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Definitions/Glossary

Client: Engineering Remediation Resources Group.
Project/Site: Horse Mountain

TestAmerica Job ID: 720-37282-1

Qualifiers

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDA	Minimum detectable activity
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 720-37282-1

Laboratory: TestAmerica Pleasanton

Narrative

Job Narrative
720-37282-1

Comments
No additional comments.

Receipt
All samples were received in good condition within temperature requirements.

Metals
No analytical or quality issues were noted.

Detection Summary

Client: Engineering Remediation Resources Group.
Project/Site: Horse Mountain

TestAmerica Job ID: 720-37282-1

Client Sample ID: HM-BKSD — Lab Sample ID: 720-37282-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	2.9		1.9	0.31	mg/Kg	4		6010B	Total/NA
Arsenic	6.6		3.8	0.32	mg/Kg	4		6010B	Total/NA
Barium	3.5		1.9	0.27	mg/Kg	4		6010B	Total/NA
Cadmium	0.42	J	0.47	0.047	mg/Kg	4		6010B	Total/NA
Chromium	790		1.9	0.20	mg/Kg	4		6010B	Total/NA
Cobalt	89		0.75	0.075	mg/Kg	4		6010B	Total/NA
Copper	1600		5.7	2.7	mg/Kg	4		6010B	Total/NA
Lead	1.4	J	1.9	0.40	mg/Kg	4		6010B	Total/NA
Nickel	1800		1.9	0.19	mg/Kg	4		6010B	Total/NA
Silver	0.24	J	0.94	0.19	mg/Kg	4		6010B	Total/NA
Vanadium	29		1.9	0.26	mg/Kg	4		6010B	Total/NA
Zinc	22		5.7	2.4	mg/Kg	4		6010B	Total/NA
Mercury	0.018		0.0088		mg/Kg	1		7471A	Total/NA

Client Sample ID: HM-TL-LOWER — Lab Sample ID: 720-37282-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	3.1		2.0	0.33	mg/Kg	4		6010B	Total/NA
Arsenic	7.0		4.0	0.34	mg/Kg	4		6010B	Total/NA
Barium	11		2.0	0.28	mg/Kg	4		6010B	Total/NA
Cadmium	0.47	J	0.50	0.050	mg/Kg	4		6010B	Total/NA
Chromium	820		2.0	0.21	mg/Kg	4		6010B	Total/NA
Cobalt	110		0.80	0.080	mg/Kg	4		6010B	Total/NA
Copper	2300		6.0	2.8	mg/Kg	4		6010B	Total/NA
Lead	11		2.0	0.42	mg/Kg	4		6010B	Total/NA
Nickel	1700		2.0	0.20	mg/Kg	4		6010B	Total/NA
Selenium	0.90	J	4.0	0.60	mg/Kg	4		6010B	Total/NA
Silver	0.38	J	1.0	0.20	mg/Kg	4		6010B	Total/NA
Thallium	0.63	J	2.0	0.58	mg/Kg	4		6010B	Total/NA
Vanadium	36		2.0	0.27	mg/Kg	4		6010B	Total/NA
Zinc	36		6.0	2.5	mg/Kg	4		6010B	Total/NA
Mercury	0.064		0.0091		mg/Kg	1		7471A	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Horse Mountain

TestAmerica Job ID: 720-37282-1

Client Sample ID: HM-BKSD

Lab Sample ID: 720-37282-1

Date Collected: 08/30/11 09:40

Matrix: Solid

Date Received: 09/01/11 10:55

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	2.9		1.9	0.31	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Arsenic	6.6		3.8	0.32	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Barium	3.5		1.9	0.27	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Beryllium	ND		0.38	0.12	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Cadmium	0.42	J	0.47	0.047	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Chromium	790		1.9	0.20	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Cobalt	89		0.75	0.075	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Copper	1600		5.7	2.7	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Lead	1.4	J	1.9	0.40	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Molybdenum	ND		1.9	0.24	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Nickel	1800		1.9	0.19	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Selenium	ND		3.8	0.57	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Silver	0.24	J	0.94	0.19	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Thallium	ND		1.9	0.55	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Vanadium	29		1.9	0.26	mg/Kg		09/07/11 14:23	09/08/11 11:33	4
Zinc	22		5.7	2.4	mg/Kg		09/07/11 14:23	09/08/11 11:33	4

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.018		0.0088		mg/Kg		09/07/11 14:26	09/08/11 15:08	1

Client Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Horse Mountain

TestAmerica Job ID: 720-37282-1

Client Sample ID: HM-TL-LOWER

Lab Sample ID: 720-37282-2

Date Collected: 08/30/11 09:45

Matrix: Solid

Date Received: 09/01/11 10:55

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	3.1		2.0	0.33	mg/Kg		09/07/11 14:23	09/08/11 15:49	4
Arsenic	7.0		4.0	0.34	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Barium	11		2.0	0.28	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Beryllium	ND		0.40	0.13	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Cadmium	0.47	J	0.50	0.050	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Chromium	820		2.0	0.21	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Cobalt	110		0.80	0.080	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Copper	2300		6.0	2.8	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Lead	11		2.0	0.42	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Molybdenum	ND		2.0	0.26	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Nickel	1700		2.0	0.20	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Selenium	0.90	J	4.0	0.60	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Silver	0.38	J	1.0	0.20	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Thallium	0.63	J	2.0	0.58	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Vanadium	36		2.0	0.27	mg/Kg		09/07/11 14:23	09/08/11 11:37	4
Zinc	36		6.0	2.5	mg/Kg		09/07/11 14:23	09/08/11 11:37	4

Method: 7471A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.064		0.0091		mg/Kg		09/07/11 14:26	09/08/11 15:10	1

QC Sample Results

Client: Engineering Remediation Resources Group.
Project/Site: Horse Mountain

TestAmerica Job ID: 720-37282-1

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 720-98624/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 98695 — **Prep Batch: 98624**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	ND		0.50	0.083	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Arsenic	ND		1.0	0.085	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Barium	ND		0.50	0.071	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Beryllium	ND		0.10	0.033	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Cadmium	ND		0.13	0.012	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Chromium	ND		0.50	0.053	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Cobalt	ND		0.20	0.020	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Copper	ND		1.5	0.71	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Lead	ND		0.50	0.11	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Molybdenum	ND		0.50	0.064	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Nickel	ND		0.50	0.051	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Selenium	ND		1.0	0.15	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Silver	ND		0.25	0.051	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Thallium	ND		0.50	0.15	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Vanadium	ND		0.50	0.068	mg/Kg		09/07/11 14:23	09/08/11 10:24	1
Zinc	ND		1.5	0.64	mg/Kg		09/07/11 14:23	09/08/11 10:24	1

Lab Sample ID: LCS 720-98624/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 98695 — **Prep Batch: 98624**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	50.0	48.8		mg/Kg		98	80 - 120
Arsenic	50.0	49.5		mg/Kg		99	80 - 120
Barium	50.0	51.4		mg/Kg		103	80 - 120
Beryllium	50.0	52.0		mg/Kg		104	80 - 120
Cadmium	50.0	50.0		mg/Kg		100	80 - 120
Chromium	50.0	51.4		mg/Kg		103	80 - 120
Cobalt	50.0	51.3		mg/Kg		103	80 - 120
Copper	50.0	50.9		mg/Kg		102	80 - 120
Lead	50.0	51.3		mg/Kg		103	80 - 120
Molybdenum	50.0	52.5		mg/Kg		105	80 - 120
Nickel	50.0	51.5		mg/Kg		103	80 - 120
Selenium	50.0	48.5		mg/Kg		97	80 - 120
Silver	25.0	24.7		mg/Kg		99	80 - 120
Thallium	50.0	51.6		mg/Kg		103	80 - 120
Vanadium	50.0	51.4		mg/Kg		103	80 - 120
Zinc	50.0	49.7		mg/Kg		99	80 - 120

Lab Sample ID: LCSD 720-98624/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 98695 — **Prep Batch: 98624**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Antimony	50.0	49.0		mg/Kg		98	80 - 120	0	20
Arsenic	50.0	49.1		mg/Kg		98	80 - 120	1	20
Barium	50.0	51.5		mg/Kg		103	80 - 120	0	20
Beryllium	50.0	52.0		mg/Kg		104	80 - 120	0	20

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: LCSD 720-98624/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 98695 — **Prep Batch: 98624**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Cadmium	50.0	49.7		mg/Kg		99	80 - 120	1	20
Chromium	50.0	51.9		mg/Kg		104	80 - 120	1	20
Cobalt	50.0	51.1		mg/Kg		102	80 - 120	0	20
Copper	50.0	51.3		mg/Kg		103	80 - 120	1	20
Lead	50.0	51.4		mg/Kg		103	80 - 120	0	20
Molybdenum	50.0	52.8		mg/Kg		106	80 - 120	0	20
Nickel	50.0	51.7		mg/Kg		103	80 - 120	0	20
Selenium	50.0	48.4		mg/Kg		97	80 - 120	0	20
Silver	25.0	24.9		mg/Kg		100	80 - 120	1	20
Thallium	50.0	51.7		mg/Kg		103	80 - 120	0	20
Vanadium	50.0	51.8		mg/Kg		104	80 - 120	1	20
Zinc	50.0	49.4		mg/Kg		99	80 - 120	0	20

Lab Sample ID: LCSSRM 720-98624/20-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 98695 — **Prep Batch: 98624**

Analyte	Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	105	61.7		mg/Kg		59	11 - 101
Arsenic	79.4	75.1		mg/Kg		95	69 - 119
Barium	391	341		mg/Kg		87	61 - 117
Beryllium	304	290		mg/Kg		95	56 - 102
Cadmium	48.3	42.8		mg/Kg		89	67 - 118
Chromium	171	162		mg/Kg		95	67 - 121
Cobalt	59.2	55.1		mg/Kg		93	64 - 133
Copper	327	314		mg/Kg		96	68 - 126
Lead	181	164		mg/Kg		91	62 - 113
Molybdenum	156	151		mg/Kg		97	62 - 128
Nickel	76.0	69.7		mg/Kg		92	65 - 117
Selenium	76.9	69.3		mg/Kg		90	63 - 126
Silver	29.1	27.0		mg/Kg		93	51 - 130
Thallium	192	173		mg/Kg		90	64 - 124
Vanadium	213	210		mg/Kg		99	67 - 123
Zinc	256	233		mg/Kg		91	62 - 110

Method: 7471A - Mercury (CVAA)

Lab Sample ID: MB 720-98625/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 98719 — **Prep Batch: 98625**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.010		mg/Kg		09/07/11 14:26	09/08/11 14:35	1

Method: 7471A - Mercury (CVAA) (Continued)

Lab Sample ID: LCS 720-98625/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 98719 — **Prep Batch: 98625**

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Mercury			0.833	0.798		mg/Kg		96	80 - 120		

Lab Sample ID: LCSD 720-98625/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 98719 — **Prep Batch: 98625**

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury			0.833	0.804		mg/Kg		97	80 - 120	1	20

QC Association Summary

Client: Engineering Remediation Resources Group.
Project/Site: Horse Mountain

TestAmerica Job ID: 720-37282-1

Metals

Prep Batch: 98624

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-37282-1	HM-BKSD	Total/NA	Solid	3050B	
720-37282-2	HM-TL-LOWER	Total/NA	Solid	3050B	
LCS 720-98624/2-A	Lab Control Sample	Total/NA	Solid	3050B	
LCSD 720-98624/3-A	Lab Control Sample Dup	Total/NA	Solid	3050B	
LCSSRM 720-98624/20-A	Lab Control Sample	Total/NA	Solid	3050B	
MB 720-98624/1-A	Method Blank	Total/NA	Solid	3050B	

Prep Batch: 98625

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-37282-1	HM-BKSD	Total/NA	Solid	7471A	
720-37282-2	HM-TL-LOWER	Total/NA	Solid	7471A	
LCS 720-98625/2-A	Lab Control Sample	Total/NA	Solid	7471A	
LCSD 720-98625/3-A	Lab Control Sample Dup	Total/NA	Solid	7471A	
MB 720-98625/1-A	Method Blank	Total/NA	Solid	7471A	

Analysis Batch: 98695

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-37282-1	HM-BKSD	Total/NA	Solid	6010B	98624
720-37282-2	HM-TL-LOWER	Total/NA	Solid	6010B	98624
LCS 720-98624/2-A	Lab Control Sample	Total/NA	Solid	6010B	98624
LCSD 720-98624/3-A	Lab Control Sample Dup	Total/NA	Solid	6010B	98624
LCSSRM 720-98624/20-A	Lab Control Sample	Total/NA	Solid	6010B	98624
MB 720-98624/1-A	Method Blank	Total/NA	Solid	6010B	98624

Analysis Batch: 98719

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-37282-1	HM-BKSD	Total/NA	Solid	7471A	98625
720-37282-2	HM-TL-LOWER	Total/NA	Solid	7471A	98625
LCS 720-98625/2-A	Lab Control Sample	Total/NA	Solid	7471A	98625
LCSD 720-98625/3-A	Lab Control Sample Dup	Total/NA	Solid	7471A	98625
MB 720-98625/1-A	Method Blank	Total/NA	Solid	7471A	98625

Analysis Batch: 98723

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
720-37282-2	HM-TL-LOWER	Total/NA	Solid	6010B	98624

Lab Chronicle

Client: Engineering Remediation Resources Group.
Project/Site: Horse Mountain

TestAmerica Job ID: 720-37282-1

Client Sample ID: HM-BKSD

Lab Sample ID: 720-37282-1

Date Collected: 08/30/11 09:40

Matrix: Solid

Date Received: 09/01/11 10:55

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			98624	09/07/11 14:23	SK	TAL SF
Total/NA	Analysis	6010B		4	98695	09/08/11 11:33	EFH	TAL SF
Total/NA	Prep	7471A			98625	09/07/11 14:26	JR	TAL SF
Total/NA	Analysis	7471A		1	98719	09/08/11 15:08	EFH	TAL SF

Client Sample ID: HM-TL-LOWER

Lab Sample ID: 720-37282-2

Date Collected: 08/30/11 09:45

Matrix: Solid

Date Received: 09/01/11 10:55

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			98624	09/07/11 14:23	SK	TAL SF
Total/NA	Analysis	6010B		4	98695	09/08/11 11:37	EFH	TAL SF
Total/NA	Prep	7471A			98625	09/07/11 14:26	JR	TAL SF
Total/NA	Analysis	7471A		1	98719	09/08/11 15:10	EFH	TAL SF
Total/NA	Analysis	6010B		4	98723	09/08/11 15:49	BA	TAL SF

Laboratory References:

TAL SF = TestAmerica Pleasanton, 1220 Quarry Lane, Pleasanton, CA 94566, TEL (925)484-1919

Certification Summary

Client: Engineering Remediation Resources Group.
Project/Site: Horse Mountain

TestAmerica Job ID: 720-37282-1

Laboratory: TestAmerica Pleasanton

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
California	State Program	9	2496	01-31-14

Method Summary

Client: Engineering Remediation Resources Group.
Project/Site: Horse Mountain

TestAmerica Job ID: 720-37282-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL SF
7471A	Mercury (CVAA)	SW846	TAL SF

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SF = TestAmerica Pleasanton, 1220 Quarry Lane, Pleasanton, CA 94566, TEL (925)484-1919

Sample Summary

Client: Engineering Remediation Resources Group.
Project/Site: Horse Mountain

TestAmerica Job ID: 720-37282-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
720-37282-1	HM-BKSD	Solid	08/30/11 09:40	09/01/11 10:55
720-37282-2	HM-TL-LOWER	Solid	08/30/11 09:45	09/01/11 10:55

ERRG
Engineering / Remediation Resources Group, Inc.
115 Sansome St., Suite 200
San Francisco, CA 94104
Phone: (415) 395-9974
Fax: : (415) 395-9983

Lab No. 720-37282
Address

133524

2/11/2013

Chain-of-Custody Record and Analysis Request

Project Contact (Hardcopy or PDF To):	California EDF Report? ☐ Yes ☐ No Navy EDD Report? ☐ Yes ☐ No
Laboratory: Test America	Electronic Deliverables To (Email Address): russell.paterson@errg.com
Phone No.: 415-848-7113 / Fax No.: 415-395-9983	Sampler : Russell Paterson
Project Number: 2011-119 / Phase # / Task # 1.01	
Project Name: Horse Mountain	Project Address:
Project Manager: Caitlin Gorman	

Analysis Request

Sample Designation	Sampling Date	Sampling Time	Container: 8 oz glass	Container: 4 oz glass	Matrix: Soil	Matrix: Water	CAM 17 metals	12 hr/ 24 hr/ 48 hr/ 72 hr/STD (1 wk) TAT	Number of Containers	Comments	For Lab Use Only
HM-BKSD	8/30/11	9:40	1		X		X	X	1		
HM-TL-Lower	8/30/11	9:45		2	X		X	X	2		

Relinquished by:	Date	Time	Received by:
[signature]	8/31/11	1634	[signature]
[signature]	9/1	9:30	[signature] TestAmerica
[signature] TestAmerica	9/1/11	1055	[signature]

Remarks: Please call Curtis Cross of USFS directly. 707-441-3508.

3.7°c

Bill to: Engineering / Remediation Resources Group, Inc.
4585 Pacheco Blvd, Suite 200
Martinez, CA 94553

Login Sample Receipt Checklist

Client: Engineering Remediation Resources Group.

Job Number: 720-37282-1

Login Number: 37282

List Source: TestAmerica Pleasanton

List Number: 1

Creator: Mullen, Joan

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	N/A	
The cooler's custody seal, if present, is intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	True	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica San Francisco
1220 Quarry Lane
Pleasanton, CA 94566
Tel: (925)484-1919

TestAmerica Job ID: 720-37282-2
Client Project/Site: Horse Mountain

For:
Engineering Remediation Resources Group.
115 Sansome Street
Suite 200
San Francisco, California 94104

Attn: Ms. Caitlin Gorman

Authorized for release by:
11/17/2011 3:48:02 PM

Dimple Sharma
Project Manager I
dimple.sharma@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Sample Summary

Client: Engineering Remediation Resources Group.
Project/Site: Horse Mountain

TestAmerica Job ID: 720-37282-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
720-37282-1	HM-BKSD	Solid	08/30/11 09:40	09/01/11 10:55
720-37282-2	HM-TL-LOWER	Solid	08/30/11 09:45	09/01/11 10:55

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Irvine
17461 Derian Avenue. Suite 100
Irvine, CA 92614
Tel: (949) 261-1022

TestAmerica Job ID: IUK1482
Client Project/Site: 720-37282-2
Client Project Description: N/A-Misc.

For:
TestAmerica San Francisco
1220 Quarry Lane
Pleasanton, CA 94566

Attn: Dimple Sharma

Authorized for release by:
11/15/2011 6:52:09 PM

Kathleen A. Robb
Client Services Manager
Kathleen.Robb@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

The test results in this report meet all 2003 NELAC and 2009 TNI requirements for accredited parameters, exceptions are noted in this report. This report may not be reproduced except in full, and with written approval from the laboratory. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Sample Summary

Client: TestAmerica San Francisco
Project/Site: 720-37282-2

TestAmerica Job ID: IUK1482

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
IUK1482-01	HM-BKSD	Solid	08/30/11 09:40	11/10/11 10:00
IUK1482-02	HM-TL-LOWER	Solid	08/30/11 09:45	11/10/11 10:00

Client Sample Results

Client: TestAmerica San Francisco
Project/Site: 720-37282-2

TestAmerica Job ID: IUK1482

Client Sample ID: HM-BKSD

Lab Sample ID: IUK1482-01

Date Collected: 08/30/11 09:40
Date Received: 11/10/11 10:00

Matrix: Solid

Method: EPA 6010B - SPLP METALS - SPLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.10		mg/l		11/12/11 13:22	11/13/11 13:19	1.0
Barium	ND		0.20		mg/l		11/12/11 13:22	11/13/11 13:19	1.0
Copper	**0.88**		0.20		mg/l		11/12/11 13:22	11/13/11 13:19	1.0
Vanadium	ND		0.20		mg/l		11/12/11 13:22	11/13/11 13:19	1.0
Zinc	ND		0.40		mg/l		11/12/11 13:22	11/13/11 13:19	1.0

Client Sample ID: HM-TL-LOWER

Lab Sample ID: IUK1482-02

Date Collected: 08/30/11 09:45
Date Received: 11/10/11 10:00

Matrix: Solid

Method: EPA 6010B - SPLP METALS - SPLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.10		mg/l		11/12/11 13:22	11/13/11 13:23	1.0
Barium	ND		0.20		mg/l		11/12/11 13:22	11/13/11 13:23	1.0
Copper	**0.40**		0.20		mg/l		11/12/11 13:22	11/13/11 13:23	1.0
Vanadium	ND		0.20		mg/l		11/12/11 13:22	11/13/11 13:23	1.0
Zinc	ND		0.40		mg/l		11/12/11 13:22	11/13/11 13:23	1.0

Lab Chronicle

Client: TestAmerica San Francisco
Project/Site: 720-37282-2

TestAmerica Job ID: IUK1482

Client Sample ID: HM-BKSD

Lab Sample ID: IUK1482-01

Date Collected: 08/30/11 09:40

Matrix: Solid

Date Received: 11/10/11 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP	Prep	EPA 1312 - Met		1.0	11K1810_P	11/12/11 13:22	CH	TAL IRV
SPLP	Analysis	EPA 6010B		1.0	11K1810	11/13/11 13:19	NH	TAL IRV

Client Sample ID: HM-TL-LOWER

Lab Sample ID: IUK1482-02

Date Collected: 08/30/11 09:45

Matrix: Solid

Date Received: 11/10/11 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP	Prep	EPA 1312 - Met		1.0	11K1810_P	11/12/11 13:22	CH	TAL IRV
SPLP	Analysis	EPA 6010B		1.0	11K1810	11/13/11 13:23	NH	TAL IRV

Laboratory References:

TAL IRV = TestAmerica Irvine, 17461 Derian Avenue. Suite 100, Irvine, CA 92614, TEL (949) 261-1022

QC Sample Results

Client: TestAmerica San Francisco
Project/Site: 720-37282-2

TestAmerica Job ID: IUK1482

Method: EPA 6010B - SPLP METALS

Lab Sample ID: 11K1810-BLK1 — **Client Sample ID: Method Blank**
Matrix: Soil — **Prep Type: SPLP**
Analysis Batch: 11K1810 — **Prep Batch: 11K1810_P**

Analyte	Blank Result	Blank Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	ND		0.10		mg/l		11/12/11 13:22	11/13/11 13:14	1.00
Barium	ND		0.20		mg/l		11/12/11 13:22	11/13/11 13:14	1.00
Copper	ND		0.20		mg/l		11/12/11 13:22	11/13/11 13:14	1.00
Vanadium	ND		0.20		mg/l		11/12/11 13:22	11/13/11 13:14	1.00
Zinc	ND		0.40		mg/l		11/12/11 13:22	11/13/11 13:14	1.00

Lab Sample ID: 11K1810-BS1 — **Client Sample ID: Lab Control Sample**
Matrix: Soil — **Prep Type: SPLP**
Analysis Batch: 11K1810 — **Prep Batch: 11K1810_P**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	2.00	1.88		mg/l		94	80 - 120
Barium	2.00	1.91		mg/l		95	80 - 120
Copper	2.00	1.91		mg/l		96	80 - 120
Vanadium	2.00	1.88		mg/l		94	80 - 120
Zinc	2.00	1.79		mg/l		89	80 - 120

Lab Sample ID: 11K1810-MS1 — **Client Sample ID: HM-BKSD**
Matrix: Soil — **Prep Type: SPLP**
Analysis Batch: 11K1810 — **Prep Batch: 11K1810_P**

Analyte	Sample Result	Sample Qualifier	Spike Added	Matrix Spike Result	Matrix Spike Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	ND		2.00	1.95		mg/l		97	75 - 125
Barium	ND		2.00	1.98		mg/l		99	75 - 125
Copper	0.885		2.00	2.73		mg/l		92	75 - 125
Vanadium	ND		2.00	1.95		mg/l		97	75 - 125
Zinc	ND		2.00	1.86		mg/l		93	75 - 125

Definitions/Glossary

Client: TestAmerica San Francisco
Project/Site: 720-37282-2

TestAmerica Job ID: IUK1482

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Certification Summary

Client: TestAmerica San Francisco
Project/Site: 720-37282-2

TestAmerica Job ID: IUK1482

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica Irvine	Arizona	State Program	9	AZ0671
TestAmerica Irvine	California	LA Cty Sanitation Districts	9	10256
TestAmerica Irvine	California	NELAC	9	1108CA
TestAmerica Irvine	California	State Program	9	2706
TestAmerica Irvine	Guam	State Program	9	Cert. No. 10.001r
TestAmerica Irvine	Hawaii	State Program	9	N/A
TestAmerica Irvine	Nevada	State Program	9	CA015312007A
TestAmerica Irvine	New Mexico	State Program	6	N/A
TestAmerica Irvine	Northern Mariana Islands	State Program	9	MP0002
TestAmerica Irvine	Oregon	NELAC	10	4005
TestAmerica Irvine	USDA	USDA		P330-09-00080

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

TestAmerica San Francisco
1220 Quarry Lane
Pleasanton, CA 94566
Phone (925) 484-1919 Fax (925) 600-3002

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

JUK1482

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Sharma, Dimple	Carrier Tracking No(s):	COC No: 720-13311.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: dimple.sharma@testamericainc.com		Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc				Job #: 720-37282-2
Address: 17461 Derian Ave, Suite 100,	Due Date Requested: 11/15/2011			
City: Irvine	TAT Requested (days):			
State, Zip: CA, 92614-5817				
Phone: 949-261-1022(Tel) 949-261-1228(Fax)	PO #:			
Email:	WO #:			
Project Name: Horse Mountain	Project #: 72007898			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUBCONTRACT/ SPLP-As, Ba, Cu, V, Zn	Total Number of containers	Special Instructions/Note:
				Preservation Code:					
HM-BKSD (720-37282-1)	8/30/11	09:40 Pacific		Solid			X	1	
HM-TL-LOWER (720-37282-2)	8/30/11	09:45 Pacific		Solid			X	1	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:		Method of Shipment:	
Relinquished by:	Date/Time: 11/9/11 – 1630	Company: TAF	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time: 11/10/11 1000	Company

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks: 5.3°C C/S

720-37282-2

Sharma, Dimple

From: Russell Paterson [russell.paterson@errg.com]
Sent: Monday, November 07, 2011 7:57 AM
To: Sharma, Dimple
Cc: Cross, Curtis (ccross@fs.fed.us); Caitlin Gorman
Subject: FW: analytical costs

Dimple,

Please analyze samples HM-BKSD and HM-TL-LOWER for SPLP arsenic, barium, copper, vanadium, and zinc. You have these samples on hold from delivery and analysis 9/1/2011. Standard TAT.

Please bill Curtis Cross at USFS directly, as before, and send results to us as well.

Thanks,
Let me know if you have any questions.

Russell Paterson
Engineering/Remediation Resources Group, Inc. (ERRG)
Direct: 415.848.7113
Main 415.395.9974
Mobile 510.295.7375

From: Cross, Curtis [mailto:ccross@fs.fed.us]
Sent: Monday, November 07, 2011 6:23 AM
To: Russell Paterson
Cc: Caitlin Gorman
Subject: RE: analytical costs

Russell,
We would like to proceed with the analysis. We will pay the lab directly for the additional costs.

Thanks,
Curtis Cross
Six Rivers National Forest
Phone (707) 441-3508
Fax (707) 441-3502

From: Russell Paterson [mailto:russell.paterson@errg.com]
Sent: Thursday, November 03, 2011 6:58 PM
To: Cross, Curtis
Cc: Caitlin Gorman
Subject: RE: analytical costs

Hi Curtis,

We have reviewed the data from the additional samples collected during our site reconnaissance at the Horse Mountain site. Both the black sand material from below the Mill site and the tailings within the channelized

Login Sample Receipt Checklist

Client: Engineering Remediation Resources Group.

Job Number: 720-37282-2

Login Number: 37282

List Source: TestAmerica San Francisco

List Number: 1

Creator: Mullen, Joan

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	N/A	
The cooler's custody seal, if present, is intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	True	

Attention: Samantha Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/18/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0001	
Customer Sample #:		HM-MS RS-01	
Date sampled:		9/4/2012	
Initials of Analyst:		KD	
Air volume:		846	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0186	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0117	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0186	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0117	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0186**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

Attention: Samantha Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/18/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0002	
Customer Sample #:		HM-MS RS-02	
Date sampled:		9/4/2012	
Initials of Analyst:		KD	
Air volume:		798	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0112	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0112	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0112	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0112	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0112**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0003	
Customer Sample #:		HM-MS RS-03	
Date sampled:		9/4/2012	
Initials of Analyst:		KD	
Air volume:		609	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		13	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0113	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0113	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0113	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0113	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0113**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0004	
Customer Sample #:		HM-MS RS-04	
Date sampled:		9/4/2012	
Initials of Analyst:		KD	
Air volume:		860	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0115	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0115	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0115	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0115	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0115**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0005	
Customer Sample #:		HM-MS HK-01	
Date sampled:		9/5/2012	
Initials of Analyst:		KD	
Air volume:		708	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		7	
Number of total asbestos structures counted:		7	
Number of Asbestos Structures > 5 microns:		7	
Number of Asbestos fibers and bundles > 5 microns:		7	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:		0.0268	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0115	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0108	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0553	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0115	Structure/cc
Concentration of Asbestos (total):		**0.0268**	**Structure/cc**

Comments:
None

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0006	
Customer Sample #:		HM-MS HK-02	
Date sampled:		9/5/2012	
Initials of Analyst:		KD	
Air volume:		705	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0182	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0115	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0182	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0115	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0182**	**Structure/cc**

Comments:
None

Robyn Denton

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0007	
Customer Sample #:		HM-MS HK-03	
Date sampled:		9/5/2012	
Initials of Analyst:		KD	
Air volume:		671	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		2	
Number of total asbestos structures counted:		2	
Number of Asbestos Structures > 5 microns:		2	
Number of Asbestos fibers and bundles > 5 microns:		2	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		2	
Concentration of Chrysotile Asbestos:	<	0.0234	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0111	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0234	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0111	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0234**	**Structure/cc**

Comments:
None

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Analysis Date: 9/19/2012
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0008	
Customer Sample #:		HM-MS HK-04	
Date sampled:		9/5/2012	
Initials of Analyst:		KD	
Air volume:		713	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0180	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0114	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0180	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0114	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0180**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

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Customer ID: ERRG25
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EMSL Order: 091211943
Analysis Date: 11/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0009	
Customer Sample #:		HM-MS ATV-01	
Date sampled:		9/5/2012	
Initials of Analyst:		FC	
Air volume:		646	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		35	
Number of total asbestos structures counted:		37	
Number of Asbestos Structures > 5 microns:		35	
Number of Asbestos fibers and bundles > 5 microns:		37	
Number of PCM equivalent asbestos structures:		8	
Number of PCM equivalent asbestos fibers:		24	
Concentration of Chrysotile Asbestos:		0.0808	Structure/cc
Concentration of Amphibole Asbestos:		0.0654	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0500	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1236	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0381	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.1048	Structure/cc
Concentration of Asbestos (total):		**0.1463**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

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Analysis Date: 11/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0010	
Customer Sample #:		HM-MS ATV-02	
Date sampled:		9/5/2012	
Initials of Analyst:		RD	
Air volume:		630	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		46	
Number of total asbestos structures counted:		48	
Number of Asbestos Structures > 5 microns:		46	
Number of Asbestos fibers and bundles > 5 microns:		48	
Number of PCM equivalent asbestos structures:		24	
Number of PCM equivalent asbestos fibers:		37	
Concentration of Chrysotile Asbestos:		0.1543	Structure/cc
Concentration of Amphibole Asbestos:		0.0309	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.1102	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.2101	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0133	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0608	Structure/cc
Concentration of Asbestos (total):		**0.1852**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton

Approved Signatory

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Project: 2011-189

Customer ID: ERRG25
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EMSL Order: 091211943
Analysis Date: 11/14/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0011	
Customer Sample #:		HM-MS ATV-03	
Date sampled:		9/5/2012	
Initials of Analyst:		LM	
Air volume:		722	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		39	
Number of total asbestos structures counted:		53	
Number of Asbestos Structures > 5 microns:		39	
Number of Asbestos fibers and bundles > 5 microns:		53	
Number of PCM equivalent asbestos structures:		6	
Number of PCM equivalent asbestos fibers:		44	
Concentration of Chrysotile Asbestos:		0.1726	Structure/cc
Concentration of Amphibole Asbestos:		0.0220	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.1268	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.2295	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0081	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0480	Structure/cc
Concentration of Asbestos (total):		**0.1946**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
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EMSL Order: 091211943
Analysis Date: 10/31/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0012	
Customer Sample #:		HM-MS ATV-04	
Date sampled:		9/5/2012	
Initials of Analyst:		PH	
Air volume:		704	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		47	
Number of total asbestos structures counted:		52	
Number of Asbestos Structures > 5 microns:		48	
Number of Asbestos fibers and bundles > 5 microns:		52	
Number of PCM equivalent asbestos structures:		23	
Number of PCM equivalent asbestos fibers:		52	
Concentration of Chrysotile Asbestos:		0.1426	Structure/cc
Concentration of Amphibole Asbestos:		0.0578	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.1004	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1966	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0324	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0954	Structure/cc
Concentration of Asbestos (total):		**0.2004**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample. Revised 11/19/12

Robyn Denton

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Customer ID: ERRG25
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EMSL Order: 091211943
Analysis Date: 10/27/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0013	
Customer Sample #:		HM-MS ATV-05	
Date sampled:		9/5/2012	
Initials of Analyst:		FC	
Air volume:		723	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		24	
Number of total asbestos structures counted:		25	
Number of Asbestos Structures > 5 microns:		24	
Number of Asbestos fibers and bundles > 5 microns:		24	
Number of PCM equivalent asbestos structures:		11	
Number of PCM equivalent asbestos fibers:		22	
Concentration of Chrysotile Asbestos:		0.0477	Structure/cc
Concentration of Amphibole Asbestos:		0.0440	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0254	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0815	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0227	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0769	Structure/cc
Concentration of Asbestos (total):		**0.0917**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

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Customer ID: ERRG25
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Analysis Date: 9/20/2012
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0014	
Customer Sample #:		HM-MS MB-01	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		544	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		14	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		3	
Number of total asbestos structures counted:		3	
Number of Asbestos Structures > 5 microns:		3	
Number of Asbestos fibers and bundles > 5 microns:		3	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		3	
Concentration of Chrysotile Asbestos:		0.0304	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0117	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0024	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0304	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0117	Structure/cc
Concentration of Asbestos (total):		**0.0304**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Suite 200
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Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/20/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0015	
Customer Sample #:		HM-MS MB-02	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		580	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		13	
Analytical Sensitivity:		0.0040	Structure/cc
Number of Primary Asbestos Structures Counted:		3	
Number of total asbestos structures counted:		3	
Number of Asbestos Structures > 5 microns:		3	
Number of Asbestos fibers and bundles > 5 microns:		3	
Number of PCM equivalent asbestos structures:		2	
Number of PCM equivalent asbestos fibers:		2	
Concentration of Chrysotile Asbestos:		0.0307	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0118	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0025	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0307	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0118	Structure/cc
Concentration of Asbestos (total):		**0.0307**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/20/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0016	
Customer Sample #:		HM-MS MB-03	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		688	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		13	
Number of total asbestos structures counted:		13	
Number of Asbestos Structures > 5 microns:		13	
Number of Asbestos fibers and bundles > 5 microns:		13	
Number of PCM equivalent asbestos structures:		9	
Number of PCM equivalent asbestos fibers:		9	
Concentration of Chrysotile Asbestos:		0.0513	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0118	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0273	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0877	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0118	Structure/cc
Concentration of Asbestos (total):		**0.0513**	**Structure/cc**

Comments:
None

Robyn Denton

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/22/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0017	
Customer Sample #:		HM-MS MB-04	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		675	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		25	
Number of total asbestos structures counted:		25	
Number of Asbestos Structures > 5 microns:		25	
Number of Asbestos fibers and bundles > 5 microns:		25	
Number of PCM equivalent asbestos structures:		22	
Number of PCM equivalent asbestos fibers:		23	
Concentration of Chrysotile Asbestos:		0.0884	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0175	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0567	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1316	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0175	Structure/cc
Concentration of Asbestos (total):		**0.0884**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/23/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0018	
Customer Sample #:		HM-MS AA-05	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		1717	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0019	Structure/cc
Number of Primary Asbestos Structures Counted:		14	
Number of total asbestos structures counted:		14	
Number of Asbestos Structures > 5 microns:		14	
Number of Asbestos fibers and bundles > 5 microns:		14	
Number of PCM equivalent asbestos structures:		9	
Number of PCM equivalent asbestos fibers:		10	
Concentration of Chrysotile Asbestos:		0.0270	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0058	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0148	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0454	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0058	Structure/cc
Concentration of Asbestos (total):		**0.0270**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/25/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0019	
Customer Sample #:		HM-MS AA-06	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		1694	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0020	Structure/cc
Number of Primary Asbestos Structures Counted:		6	
Number of total asbestos structures counted:		6	
Number of Asbestos Structures > 5 microns:		6	
Number of Asbestos fibers and bundles > 5 microns:		6	
Number of PCM equivalent asbestos structures:		6	
Number of PCM equivalent asbestos fibers:		6	
Concentration of Chrysotile Asbestos:		0.0117	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0059	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0043	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0256	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0059	Structure/cc
Concentration of Asbestos (total):		**0.0117**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/7/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0020	
Customer Sample #:		HM-AP ATV-01	
Date sampled:		9/6/2012	
Initials of Analyst:		FC	
Air volume:		595	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		13	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		9	
Number of total asbestos structures counted:		10	
Number of Asbestos Structures > 5 microns:		9	
Number of Asbestos fibers and bundles > 5 microns:		10	
Number of PCM equivalent asbestos structures:		5	
Number of PCM equivalent asbestos fibers:		10	
Concentration of Chrysotile Asbestos:		0.0232	Structure/cc
Concentration of Amphibole Asbestos:		0.0154	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0085	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0504	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0042	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0395	Structure/cc
Concentration of Asbestos (total):		**0.0386**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/12/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0021	
Customer Sample #:		HM-AP ATV-02	
Date sampled:		9/6/2012	
Initials of Analyst:		FC	
Air volume:		660	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		30	
Number of total asbestos structures counted:		33	
Number of Asbestos Structures > 5 microns:		30	
Number of Asbestos fibers and bundles > 5 microns:		33	
Number of PCM equivalent asbestos structures:		6	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:		0.0994	Structure/cc
Concentration of Amphibole Asbestos:		0.0221	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0655	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1447	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0081	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0481	Structure/cc
Concentration of Asbestos (total):		**0.1215**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/2/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0022	
Customer Sample #:		HM-AP ATV-03	
Date sampled:		9/6/2012	
Initials of Analyst:		PH	
Air volume:		568	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		14	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		43	
Number of total asbestos structures counted:		49	
Number of Asbestos Structures > 5 microns:		43	
Number of Asbestos fibers and bundles > 5 microns:		49	
Number of PCM equivalent asbestos structures:		31	
Number of PCM equivalent asbestos fibers:		50	
Concentration of Chrysotile Asbestos:		0.1247	Structure/cc
Concentration of Amphibole Asbestos:		0.0550	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0864	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1743	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0308	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0907	Structure/cc
Concentration of Asbestos (total):		**0.1797**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/6/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0023	
Customer Sample #:		HM-AP ATV-04	
Date sampled:		9/6/2012	
Initials of Analyst:		PH	
Air volume:		662	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		11	
Number of total asbestos structures counted:		11	
Number of Asbestos Structures > 5 microns:		11	
Number of Asbestos fibers and bundles > 5 microns:		11	
Number of PCM equivalent asbestos structures:		7	
Number of PCM equivalent asbestos fibers:		11	
Concentration of Chrysotile Asbestos:		0.0301	Structure/cc
Concentration of Amphibole Asbestos:		0.0150	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0130	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0592	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0041	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0385	Structure/cc
Concentration of Asbestos (total):		**0.0451**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/5/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0024	
Customer Sample #:		HM-AP MB-01	
Date sampled:		9/10/2012	
Initials of Analyst:		FC	
Air volume:		792	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		11	
Number of total asbestos structures counted:		11	
Number of Asbestos Structures > 5 microns:		11	
Number of Asbestos fibers and bundles > 5 microns:		11	
Number of PCM equivalent asbestos structures:		8	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:		0.0188	Structure/cc
Concentration of Amphibole Asbestos:		0.0226	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0061	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0440	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0083	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0492	Structure/cc
Concentration of Asbestos (total):		**0.0415**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton

Approved Signatory

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/25/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0025	
Customer Sample #:		HM-AP MB-02	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		786	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		17	
Number of total asbestos structures counted:		17	
Number of Asbestos Structures > 5 microns:		17	
Number of Asbestos fibers and bundles > 5 microns:		17	
Number of PCM equivalent asbestos structures:		16	
Number of PCM equivalent asbestos fibers:		16	
Concentration of Chrysotile Asbestos:		0.0646	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0114	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0376	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1034	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0114	Structure/cc
Concentration of Asbestos (total):		**0.0646**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/26/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0026	
Customer Sample #:		HM-AP MB-03	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		730	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		15	
Number of total asbestos structures counted:		15	
Number of Asbestos Structures > 5 microns:		15	
Number of Asbestos fibers and bundles > 5 microns:		15	
Number of PCM equivalent asbestos structures:		12	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0520	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0176	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0284	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0873	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0176	Structure/cc
Concentration of Asbestos (total):		**0.0520**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

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Customer ID: ERRG25
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Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/26/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0027	
Customer Sample #:		HM-AP MB-04	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		705	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		15	
Number of total asbestos structures counted:		15	
Number of Asbestos Structures > 5 microns:		15	
Number of Asbestos fibers and bundles > 5 microns:		15	
Number of PCM equivalent asbestos structures:		12	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0577	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0115	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0323	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0952	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0115	Structure/cc
Concentration of Asbestos (total):		**0.0577**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/27/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0028	
Customer Sample #:		HM-AP MB-05	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		600	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		14	
Analytical Sensitivity:		0.0036	Structure/cc
Number of Primary Asbestos Structures Counted:		19	
Number of total asbestos structures counted:		19	
Number of Asbestos Structures > 5 microns:		19	
Number of Asbestos fibers and bundles > 5 microns:		19	
Number of PCM equivalent asbestos structures:		17	
Number of PCM equivalent asbestos fibers:		19	
Concentration of Chrysotile Asbestos:		0.0568	Structure/cc
Concentration of Amphibole Asbestos:		0.0275	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0325	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0923	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0022	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0275	Structure/cc
Concentration of Asbestos (total):		**0.0844**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/30/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0029	
Customer Sample #:		HM-AP HK-01	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		710	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		21	
Number of total asbestos structures counted:		21	
Number of Asbestos Structures > 5 microns:		21	
Number of Asbestos fibers and bundles > 5 microns:		21	
Number of PCM equivalent asbestos structures:		11	
Number of PCM equivalent asbestos fibers:		13	
Concentration of Chrysotile Asbestos:		0.0802	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0114	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0497	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1227	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0114	Structure/cc
Concentration of Asbestos (total):		**0.0802**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/3/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0030	
Customer Sample #:		HM-AP HK-02	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		707	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0035	Structure/cc
Number of Primary Asbestos Structures Counted:		32	
Number of total asbestos structures counted:		32	
Number of Asbestos Structures > 5 microns:		32	
Number of Asbestos fibers and bundles > 5 microns:		32	
Number of PCM equivalent asbestos structures:		27	
Number of PCM equivalent asbestos fibers:		28	
Concentration of Chrysotile Asbestos:		0.1091	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0167	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0741	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1548	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0167	Structure/cc
Concentration of Asbestos (total):		**0.1091**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/3/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0031	
Customer Sample #:		HM-AP HK-03	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		668	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		12	
Number of total asbestos structures counted:		12	
Number of Asbestos Structures > 5 microns:		12	
Number of Asbestos fibers and bundles > 5 microns:		12	
Number of PCM equivalent asbestos structures:		10	
Number of PCM equivalent asbestos fibers:		11	
Concentration of Chrysotile Asbestos:		0.0447	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0111	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0231	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0780	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0111	Structure/cc
Concentration of Asbestos (total):		**0.0447**	**Structure/cc**

Comments:
None

Robyn Denton

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0032	
Customer Sample #:		HM-AP HK-04	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		685	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0036	Structure/cc
Number of Primary Asbestos Structures Counted:		26	
Number of total asbestos structures counted:		26	
Number of Asbestos Structures > 5 microns:		26	
Number of Asbestos fibers and bundles > 5 microns:		26	
Number of PCM equivalent asbestos structures:		15	
Number of PCM equivalent asbestos fibers:		20	
Concentration of Chrysotile Asbestos:		0.0908	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0172	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0587	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1340	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0172	Structure/cc
Concentration of Asbestos (total):		**0.0908**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0033	
Customer Sample #:		HM-AP HK-05	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		735	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		11	
Number of total asbestos structures counted:		11	
Number of Asbestos Structures > 5 microns:		11	
Number of Asbestos fibers and bundles > 5 microns:		11	
Number of PCM equivalent asbestos structures:		8	
Number of PCM equivalent asbestos fibers:		8	
Concentration of Chrysotile Asbestos:		0.0295	Structure/cc
Concentration of Amphibole Asbestos:		0.0286	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0128	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0582	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0023	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0286	Structure/cc
Concentration of Asbestos (total):		**0.0581**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0034	
Customer Sample #:		HM-AP AA-03	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		1925	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		8	
Analytical Sensitivity:		0.0019	Structure/cc
Number of Primary Asbestos Structures Counted:		6	
Number of total asbestos structures counted:		6	
Number of Asbestos Structures > 5 microns:		6	
Number of Asbestos fibers and bundles > 5 microns:		6	
Number of PCM equivalent asbestos structures:		5	
Number of PCM equivalent asbestos fibers:		5	
Concentration of Chrysotile Asbestos:		0.0116	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0058	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0043	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0253	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0058	Structure/cc
Concentration of Asbestos (total):		**0.0116**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0035	
Customer Sample #:		HM-AP AA-04	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		1919	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		8	
Analytical Sensitivity:		0.0019	Structure/cc
Number of Primary Asbestos Structures Counted:		15	
Number of total asbestos structures counted:		15	
Number of Asbestos Structures > 5 microns:		15	
Number of Asbestos fibers and bundles > 5 microns:		15	
Number of PCM equivalent asbestos structures:		11	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0253	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0122	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0135	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0432	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0122	Structure/cc
Concentration of Asbestos (total):		**0.0253**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/13/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0036	
Customer Sample #:		HM-OP ATV-01	
Date sampled:		9/7/2012	
Initials of Analyst:		PH	
Air volume:		673	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0036	Structure/cc
Number of Primary Asbestos Structures Counted:		13	
Number of total asbestos structures counted:		13	
Number of Asbestos Structures > 5 microns:		13	
Number of Asbestos fibers and bundles > 5 microns:		13	
Number of PCM equivalent asbestos structures:		9	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0397	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0228	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0198	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0711	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0228	Structure/cc
Concentration of Asbestos (total):		**0.0397**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/9/2012 & 12/20/2012
Report Date: 12/20/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0037	
Customer Sample #:		HM-OP ATV-02	
Date sampled:		9/7/2012	
Initials of Analyst:		FC	
Air volume:		616	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		23	
Number of total asbestos structures counted:		23	
Number of Asbestos Structures > 5 microns:		23	
Number of Asbestos fibers and bundles > 5 microns:		23	
Number of PCM equivalent asbestos structures:		5	
Number of PCM equivalent asbestos fibers:		14	
Concentration of Chrysotile Asbestos:		0.0434	Structure/cc
Concentration of Amphibole Asbestos:		0.0473	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0217	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0777	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0245	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0827	Structure/cc
Concentration of Asbestos (total):		**0.0908**	**Structure/cc**

Comments:
Particulate loading estimated at 35%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample. Revised report, additional grid openings analyzed to meet Analytical Sensitivity.

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/1/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0038	
Customer Sample #:		HM-OP ATV-03	
Date sampled:		9/7/2012	
Initials of Analyst:		FC	
Air volume:		695	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		17	
Number of total asbestos structures counted:		20	
Number of Asbestos Structures > 5 microns:		15	
Number of Asbestos fibers and bundles > 5 microns:		20	
Number of PCM equivalent asbestos structures:		2	
Number of PCM equivalent asbestos fibers:		19	
Concentration of Chrysotile Asbestos:		0.0649	Structure/cc
Concentration of Amphibole Asbestos:		0.0296	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0378	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1038	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0024	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0296	Structure/cc
Concentration of Asbestos (total):		**0.0944**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/6/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0039	
Customer Sample #:		HM-OP ATV-04	
Date sampled:		9/7/2012	
Initials of Analyst:		PH	
Air volume:		736	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		13	
Number of total asbestos structures counted:		13	
Number of Asbestos Structures > 5 microns:		13	
Number of Asbestos fibers and bundles > 5 microns:		13	
Number of PCM equivalent asbestos structures:		7	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0479	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0110	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0255	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0820	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0110	Structure/cc
Concentration of Asbestos (total):		**0.0479**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/9/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0040	
Customer Sample #:		HM-OP ATV-05	
Date sampled:		9/7/2012	
Initials of Analyst:		FC	
Air volume:		694	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		17	
Number of total asbestos structures counted:		18	
Number of Asbestos Structures > 5 microns:		17	
Number of Asbestos fibers and bundles > 5 microns:		18	
Number of PCM equivalent asbestos structures:		5	
Number of PCM equivalent asbestos fibers:		10	
Concentration of Chrysotile Asbestos:		0.0688	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0114	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0408	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1087	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0114	Structure/cc
Concentration of Asbestos (total):		**0.0688**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/2/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0041	
Customer Sample #:		HM-OP MB-01	
Date sampled:		9/7/2012	
Initials of Analyst:		FC	
Air volume:		733	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0036	Structure/cc
Number of Primary Asbestos Structures Counted:		8	
Number of total asbestos structures counted:		11	
Number of Asbestos Structures > 5 microns:		8	
Number of Asbestos fibers and bundles > 5 microns:		11	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		8	
Concentration of Chrysotile Asbestos:		0.0326	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0228	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0149	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0618	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0228	Structure/cc
Concentration of Asbestos (total):		**0.0326**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton

Approved Signatory

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EMSL Order: 091211943
Analysis Date: 10/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0042	
Customer Sample #:		HM-OP MB-02	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		696	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		17	
Number of total asbestos structures counted:		17	
Number of Asbestos Structures > 5 microns:		17	
Number of Asbestos fibers and bundles > 5 microns:		17	
Number of PCM equivalent asbestos structures:		16	
Number of PCM equivalent asbestos fibers:		16	
Concentration of Chrysotile Asbestos:		0.0546	Structure/cc
Concentration of Amphibole Asbestos:		0.0302	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0298	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0916	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0024	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0302	Structure/cc
Concentration of Asbestos (total):		**0.0848**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/7/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0043	
Customer Sample #:		HM-OP MB-03	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		726	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		39	
Number of total asbestos structures counted:		39	
Number of Asbestos Structures > 5 microns:		39	
Number of Asbestos fibers and bundles > 5 microns:		39	
Number of PCM equivalent asbestos structures:		29	
Number of PCM equivalent asbestos fibers:		31	
Concentration of Chrysotile Asbestos:		0.1420	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0177	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.1005	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1949	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0177	Structure/cc
Concentration of Asbestos (total):		**0.1420**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/5/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0044	
Customer Sample #:		HM-OP MB-04	
Date sampled:		9/7/2012	
Initials of Analyst:		PH	
Air volume:		768	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		7	
Number of total asbestos structures counted:		8	
Number of Asbestos Structures > 5 microns:		7	
Number of Asbestos fibers and bundles > 5 microns:		8	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		8	
Concentration of Chrysotile Asbestos:		0.0194	Structure/cc
Concentration of Amphibole Asbestos:		0.0301	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0063	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0453	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0024	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0301	Structure/cc
Concentration of Asbestos (total):		**0.0495**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/7/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0045	
Customer Sample #:		HM-OP HK-01	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		726	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		21	
Number of total asbestos structures counted:		21	
Number of Asbestos Structures > 5 microns:		21	
Number of Asbestos fibers and bundles > 5 microns:		21	
Number of PCM equivalent asbestos structures:		12	
Number of PCM equivalent asbestos fibers:		14	
Concentration of Chrysotile Asbestos:		0.0673	Structure/cc
Concentration of Amphibole Asbestos:		0.0290	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0399	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1063	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0023	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0290	Structure/cc
Concentration of Asbestos (total):		**0.0962**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

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Customer ID: ERRG25
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Received: 9/17/12 11:05 AM

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Analysis Date: 10/7/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0046	
Customer Sample #:		HM-OP HK-02	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		772	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		22	
Number of total asbestos structures counted:		22	
Number of Asbestos Structures > 5 microns:		22	
Number of Asbestos fibers and bundles > 5 microns:		22	
Number of PCM equivalent asbestos structures:		17	
Number of PCM equivalent asbestos fibers:		18	
Concentration of Chrysotile Asbestos:		0.0812	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0183	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0503	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1241	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0183	Structure/cc
Concentration of Asbestos (total):		**0.0812**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/8/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0047	
Customer Sample #:		HM-OP HK-03	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		717	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		7	
Number of total asbestos structures counted:		7	
Number of Asbestos Structures > 5 microns:		7	
Number of Asbestos fibers and bundles > 5 microns:		7	
Number of PCM equivalent asbestos structures:		7	
Number of PCM equivalent asbestos fibers:		7	
Concentration of Chrysotile Asbestos:		0.0189	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0238	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0061	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0442	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0238	Structure/cc
Concentration of Asbestos (total):		**0.0238**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/8/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0048	
Customer Sample #:		HM-OP HK-04	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		726	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		5	
Number of total asbestos structures counted:		5	
Number of Asbestos Structures > 5 microns:		5	
Number of Asbestos fibers and bundles > 5 microns:		5	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		3	
Concentration of Chrysotile Asbestos:		0.0187	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0112	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0061	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0436	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0112	Structure/cc
Concentration of Asbestos (total):		**0.0187**	**Structure/cc**

Comments:
None

Robyn Denton

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Customer ID: ERRG25
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Analysis Date: 10/8/2012
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0049	
Customer Sample #:		HM-OP HK-05	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		654	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		14	
Number of total asbestos structures counted:		14	
Number of Asbestos Structures > 5 microns:		14	
Number of Asbestos fibers and bundles > 5 microns:		14	
Number of PCM equivalent asbestos structures:		7	
Number of PCM equivalent asbestos fibers:		7	
Concentration of Chrysotile Asbestos:		0.0418	Structure/cc
Concentration of Amphibole Asbestos:		0.0295	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0209	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0749	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0024	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0295	Structure/cc
Concentration of Asbestos (total):		**0.0713**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

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Customer ID: ERRG25
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EMSL Order: 091211943
Analysis Date: 10/8/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0050	
Customer Sample #:		HM-OP RS-01	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		760	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		3	
Number of total asbestos structures counted:		3	
Number of Asbestos Structures > 5 microns:		3	
Number of Asbestos fibers and bundles > 5 microns:		3	
Number of PCM equivalent asbestos structures:		2	
Number of PCM equivalent asbestos fibers:		2	
Concentration of Chrysotile Asbestos:		0.0304	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0117	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0024	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0304	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0117	Structure/cc
Concentration of Asbestos (total):		**0.0304**	**Structure/cc**

Comments:
None

Robyn Denton

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Customer ID: ERRG25
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0051	
Customer Sample #:		HM-OP RS-02	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		737	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		14	
Number of total asbestos structures counted:		14	
Number of Asbestos Structures > 5 microns:		14	
Number of Asbestos fibers and bundles > 5 microns:		14	
Number of PCM equivalent asbestos structures:		12	
Number of PCM equivalent asbestos fibers:		13	
Concentration of Chrysotile Asbestos:		0.0515	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0110	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0282	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0865	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0110	Structure/cc
Concentration of Asbestos (total):		**0.0515**	**Structure/cc**

Comments:
None

Robyn Denton

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/9/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0052	
Customer Sample #:		HM-OP RS-03	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		735	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		17	
Number of total asbestos structures counted:		17	
Number of Asbestos Structures > 5 microns:		17	
Number of Asbestos fibers and bundles > 5 microns:		17	
Number of PCM equivalent asbestos structures:		12	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0554	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0233	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0310	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0913	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0233	Structure/cc
Concentration of Asbestos (total):		**0.0554**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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4585 Pacheco Blvd.
Suite 200
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Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/9/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0053	
Customer Sample #:		HM-OP RS-04	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		797	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		18	
Number of total asbestos structures counted:		18	
Number of Asbestos Structures > 5 microns:		18	
Number of Asbestos fibers and bundles > 5 microns:		18	
Number of PCM equivalent asbestos structures:		11	
Number of PCM equivalent asbestos fibers:		14	
Concentration of Chrysotile Asbestos:		0.0599	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0236	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0342	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0973	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0236	Structure/cc
Concentration of Asbestos (total):		**0.0599**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0054	
Customer Sample #:		HM-OP RS-05	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		723	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		4	
Number of total asbestos structures counted:		4	
Number of Asbestos Structures > 5 microns:		4	
Number of Asbestos fibers and bundles > 5 microns:		4	
Number of PCM equivalent asbestos structures:		4	
Number of PCM equivalent asbestos fibers:		4	
Concentration of Chrysotile Asbestos:		0.0150	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0112	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0041	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0384	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0112	Structure/cc
Concentration of Asbestos (total):		**0.0150**	**Structure/cc**

Comments:
None

Robyn Denton

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0055	
Customer Sample #:		HM-OP AA-01	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		1589	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0019	Structure/cc
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0056	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0056	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0056	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0056	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0056**	**Structure/cc**

Comments:
None

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0056	
Customer Sample #:		HM-OP AA-02	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		1657	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0020	Structure/cc
Number of Primary Asbestos Structures Counted:		2	
Number of total asbestos structures counted:		2	
Number of Asbestos Structures > 5 microns:		2	
Number of Asbestos fibers and bundles > 5 microns:		2	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:	<	0.0126	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0060	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0126	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0060	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0126**	**Structure/cc**

Comments:
None

Robyn Denton

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Analysis Date: 11/9/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0057	
Customer Sample #:		HM-BG ATV-01	
Date sampled:		9/9/2012	
Initials of Analyst:		FC	
Air volume:		720	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		20	
Number of total asbestos structures counted:		21	
Number of Asbestos Structures > 5 microns:		20	
Number of Asbestos fibers and bundles > 5 microns:		21	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		13	
Concentration of Chrysotile Asbestos:		0.0626	Structure/cc
Concentration of Amphibole Asbestos:		0.0147	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0365	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1002	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0040	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0377	Structure/cc
Concentration of Asbestos (total):		**0.0773**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
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EMSL Order: 091211943
Analysis Date: 11/12/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0058	
Customer Sample #:		HM-BG ATV-02	
Date sampled:		9/9/2012	
Initials of Analyst:		CC	
Air volume:		582	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0073	mm²
Number of Grid Openings Analyzed:		23	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		36	
Number of total asbestos structures counted:		39	
Number of Asbestos Structures > 5 microns:		36	
Number of Asbestos fibers and bundles > 5 microns:		39	
Number of PCM equivalent asbestos structures:		13	
Number of PCM equivalent asbestos fibers:		39	
Concentration of Chrysotile Asbestos:		0.1300	Structure/cc
Concentration of Amphibole Asbestos:		0.0236	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0895	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1826	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0087	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0515	Structure/cc
Concentration of Asbestos (total):		**0.1537**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton

Approved Signatory

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/14/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0059	
Customer Sample #:		HM-BG ATV-03	
Date sampled:		9/9/2012	
Initials of Analyst:		DC	
Air volume:		615	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0073	mm²
Number of Grid Openings Analyzed:		22	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		35	
Number of total asbestos structures counted:		38	
Number of Asbestos Structures > 5 microns:		35	
Number of Asbestos fibers and bundles > 5 microns:		38	
Number of PCM equivalent asbestos structures:		17	
Number of PCM equivalent asbestos fibers:		38	
Concentration of Chrysotile Asbestos:		0.1247	Structure/cc
Concentration of Amphibole Asbestos:		0.0234	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0853	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1761	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0086	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0509	Structure/cc
Concentration of Asbestos (total):		**0.1481**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
Customer PO:
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EMSL Order: 091211943
Analysis Date: 11/16/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0060	
Customer Sample #:		HM-BG ATV-04	
Date sampled:		9/9/2012	
Initials of Analyst:		FC	
Air volume:		660	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		13	
Number of total asbestos structures counted:		14	
Number of Asbestos Structures > 5 microns:		13	
Number of Asbestos fibers and bundles > 5 microns:		14	
Number of PCM equivalent asbestos structures:		2	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0368	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0175	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0177	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0677	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0175	Structure/cc
Concentration of Asbestos (total):		**0.0368**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0061	
Customer Sample #:		HM-BG MB-01	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		765	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0185	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0117	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0185	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0117	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0185**	**Structure/cc**

Comments:
None

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0062	
Customer Sample #:		HM-BG MB-02	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		758	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		23	
Number of total asbestos structures counted:		23	
Number of Asbestos Structures > 5 microns:		23	
Number of Asbestos fibers and bundles > 5 microns:		23	
Number of PCM equivalent asbestos structures:		18	
Number of PCM equivalent asbestos fibers:		18	
Concentration of Chrysotile Asbestos:		0.0630	Structure/cc
Concentration of Amphibole Asbestos:		0.0276	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0360	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1023	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0111	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0568	Structure/cc
Concentration of Asbestos (total):		**0.0906**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0063	
Customer Sample #:		HM-BG MB-03	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		693	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		2	
Number of total asbestos structures counted:		2	
Number of Asbestos Structures > 5 microns:		2	
Number of Asbestos fibers and bundles > 5 microns:		2	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		2	
Concentration of Chrysotile Asbestos:	<	0.0247	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0117	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0247	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0117	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0247**	**Structure/cc**

Comments:
None

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0064	
Customer Sample #:		HM-BG MB-04	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		684	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0040	Structure/cc
Number of Primary Asbestos Structures Counted:		16	
Number of total asbestos structures counted:		16	
Number of Asbestos Structures > 5 microns:		16	
Number of Asbestos fibers and bundles > 5 microns:		16	
Number of PCM equivalent asbestos structures:		8	
Number of PCM equivalent asbestos fibers:		10	
Concentration of Chrysotile Asbestos:		0.0635	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0119	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0363	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1031	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0119	Structure/cc
Concentration of Asbestos (total):		**0.0635**	**Structure/cc**

Comments:
None

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Analysis Date: 10/10/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0065	
Customer Sample #:		HM-BG HK-01	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		733	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		4	
Number of total asbestos structures counted:		4	
Number of Asbestos Structures > 5 microns:		4	
Number of Asbestos fibers and bundles > 5 microns:		4	
Number of PCM equivalent asbestos structures:		4	
Number of PCM equivalent asbestos fibers:		4	
Concentration of Chrysotile Asbestos:	<	0.0233	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0233	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0233	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0233	Structure/cc
Concentration of Asbestos (total):		**0.0233**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

Approved Signatory

Attention: Samantha Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/10/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0066	
Customer Sample #:		HM-BG HK-02	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		810	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		4	
Number of total asbestos structures counted:		4	
Number of Asbestos Structures > 5 microns:		4	
Number of Asbestos fibers and bundles > 5 microns:		4	
Number of PCM equivalent asbestos structures:		4	
Number of PCM equivalent asbestos fibers:		4	
Concentration of Chrysotile Asbestos:		0.0147	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0110	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0040	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0377	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0110	Structure/cc
Concentration of Asbestos (total):		**0.0147**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Customer ID: ERRG25
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Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/10/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0067	
Customer Sample #:		HM-BG HK-03	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		724	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		22	
Number of total asbestos structures counted:		22	
Number of Asbestos Structures > 5 microns:		22	
Number of Asbestos fibers and bundles > 5 microns:		22	
Number of PCM equivalent asbestos structures:		14	
Number of PCM equivalent asbestos fibers:		17	
Concentration of Chrysotile Asbestos:		0.0600	Structure/cc
Concentration of Amphibole Asbestos:		0.0225	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0343	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0974	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0083	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0489	Structure/cc
Concentration of Asbestos (total):		**0.0824**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/15/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0068	
Customer Sample #:		HM-BG HK-04	
Date sampled:		9/11/2012	
Initials of Analyst:		FC	
Air volume:		763	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0035	Structure/cc
Number of Primary Asbestos Structures Counted:		10	
Number of total asbestos structures counted:		10	
Number of Asbestos Structures > 5 microns:		10	
Number of Asbestos fibers and bundles > 5 microns:		10	
Number of PCM equivalent asbestos structures:		5	
Number of PCM equivalent asbestos fibers:		8	
Concentration of Chrysotile Asbestos:		0.0209	Structure/cc
Concentration of Amphibole Asbestos:		0.0139	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0077	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0454	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0038	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0356	Structure/cc
Concentration of Asbestos (total):		**0.0348**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/10/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0069	
Customer Sample #:		HM-BG RS-01	
Date sampled:		9/12/2012	
Initials of Analyst:		KD	
Air volume:		705	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		5	
Number of total asbestos structures counted:		5	
Number of Asbestos Structures > 5 microns:		5	
Number of Asbestos fibers and bundles > 5 microns:		5	
Number of PCM equivalent asbestos structures:		4	
Number of PCM equivalent asbestos fibers:		4	
Concentration of Chrysotile Asbestos:		0.0192	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0115	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0062	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0449	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0115	Structure/cc
Concentration of Asbestos (total):		**0.0192**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/10/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0070	
Customer Sample #:		HM-BG RS-02	
Date sampled:		9/12/2012	
Initials of Analyst:		KD	
Air volume:		705	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		7	
Number of total asbestos structures counted:		7	
Number of Asbestos Structures > 5 microns:		7	
Number of Asbestos fibers and bundles > 5 microns:		7	
Number of PCM equivalent asbestos structures:		4	
Number of PCM equivalent asbestos fibers:		6	
Concentration of Chrysotile Asbestos:		0.0231	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0182	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0085	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0503	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0182	Structure/cc
Concentration of Asbestos (total):		**0.0231**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

Approved Signatory

Attention: Samantha Knight
Engineering/Remediation Resources Group
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

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Analysis Date: 10/11/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0071	
Customer Sample #:		HM-BG RS-03	
Date sampled:		9/12/2012	
Initials of Analyst:		KD	
Air volume:		684	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0040	Structure/cc
Number of Primary Asbestos Structures Counted:		3	
Number of total asbestos structures counted:		3	
Number of Asbestos Structures > 5 microns:		3	
Number of Asbestos fibers and bundles > 5 microns:		3	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:		0.0307	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0119	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0025	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0307	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0119	Structure/cc
Concentration of Asbestos (total):		**0.0307**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
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EMSL Order: 091211943
Analysis Date: 10/11/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0072	
Customer Sample #:		HM-BG RS-04	
Date sampled:		9/12/2012	
Initials of Analyst:		KD	
Air volume:		678	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0040	Structure/cc
Number of Primary Asbestos Structures Counted:		3	
Number of total asbestos structures counted:		3	
Number of Asbestos Structures > 5 microns:		3	
Number of Asbestos fibers and bundles > 5 microns:		3	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:		0.0310	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0120	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0025	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0310	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0120	Structure/cc
Concentration of Asbestos (total):		**0.0310**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
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EMSL Order: 091211943
Analysis Date: 10/11/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0073	
Customer Sample #:		HM-BG AA-01	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		1854	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0018	Structure/cc
Number of Primary Asbestos Structures Counted:		6	
Number of total asbestos structures counted:		6	
Number of Asbestos Structures > 5 microns:		6	
Number of Asbestos fibers and bundles > 5 microns:		6	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		4	
Concentration of Chrysotile Asbestos:		0.0107	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0053	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0039	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0234	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0053	Structure/cc
Concentration of Asbestos (total):		**0.0107**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
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Analysis Date: 10/11/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0074	
Customer Sample #:		HM-BG AA-02	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		1970	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		8	
Analytical Sensitivity:		0.0019	Structure/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:	<	0.0090	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0057	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0090	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0057	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0090**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
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EMSL Order: 091211943
Analysis Date: 10/11/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0075	
Customer Sample #:		HM-BG AA-03	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		1836	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0018	Structure/cc
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0054	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0054	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0054	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0054	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0054**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/11/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0076	
Customer Sample #:		HM-FB	
Date sampled:		9/17/2012	
Initials of Analyst:		KD	
Air volume:		0	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		7.7519	Structure/mm²
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	23.1783	Structure/mm²
Concentration of Amphibole Asbestos:	<	23.1783	Structure/mm²
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/mm²
Upper 95% Confidence Limit (Chrysotile)		23.1783	Structure/mm²
Lower 95% Confidence Limit (Amphibole)		NA	Structure/mm²
Upper 95% Confidence Limit (Amphibole)		23.1783	Structure/mm²
Concentration of Asbestos (total):	**<**	**23.1783**	**Structure/mm²**

Comments:
None

Robyn Denton

Approved Signatory

EMSL Analytical, Inc.

Asbestos Data Package

EMSL Order IDs 091211943
Data Package 1

Prepared By: EMSL Special Projects Group

Date: December 14, 2012

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8. Customer Correspondence

1. Case Narrative

EMSL ANALYTICAL, INC.
200 RT. 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-0235

November 23, 2012

Engineering/Remediation Resources Group
Samantha Caruthers-Knight
4585 Pacheco Blvd
Suite 200
Martinez, CA 94553
Phone: (925)-969-0750

Re: Narrative, TEM ISO 10312; EMSL order ID 091211943

Dear Samantha:

On September 17, 2012, EMSL Analytical, Inc. in San Leandro, CA received seventy six (76) air samples by walk in delivery for asbestos content analysis via TEM ISO 10312. The samples were logged in following normal lab procedures. Samples were received under Chain of Custody from Engineering/Remediation Resources Group and arrived in good condition.

TEM ISO 10312

TEM analysis was performed using the following method: TEM ISO 10312: 1995-05-01 Ambient Air-Determination of Asbestos Fibres-Direct Transfer Transmission Electron Microscopy. The client specified analysis utilizing specifications found in Annex E. Samantha Caruthers-Knight provided further clarifications on September 17th and 18th for the required analytical sensitivities (see below) and counting rules (to include more fiber sizes). On October 2, 2012, the client instructed the lab that the counting rules were to be changed to count only structures >5 um in length.

The client specified modifications to the method are outlined below.

- Analytical sensitivities of 0.002 S/cc for Ambient Air Samples and 0.004 S/cc for Activity Based Samples were specified verbally by client.
- All field blanks and laboratory blanks each had 10 grid openings analyzed.
- PCM (0.8u) 25mm MCE cassettes were used for sampling.
- Aspect ratio applied was modified to greater than or equal to 3:1.
- A minimum of 4 grid openings were analyzed, from 2 separate grid preparations.
- Width requirement of countable structures was altered to 0.2 microns.
- Structures greater than 5.0 microns in length were recorded.
- Overloading Criteria was amended to 25%

Results
Samples were analyzed via transmission electron microscopy (TEM) using procedures from ISO 10312. Analysis was performed on a JEOL 100CXII and or JEOL 1200 EX microscope at approximately 19,000X. Analysis was performed in EMSL's San Leandro, CA, Cinnaminson, NJ and Carle Place, NY laboratories. All of these locations possess California state certification for asbestos analysis. Certification numbers can be found on our website, www.emsl.com. The heavy particulate loading of some samples required several sample re-preparations to complete analysis.

Analysis was completed October 24th by the San Leandro Lab. Out of the seventy six samples submitted twenty-two were deemed overloaded as their particulate loading exceeds 10% with 10 of those being greater

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than 25%. On October 25th and 26th, EMSL was directed to analyze all overloaded samples by direct examination ISO 10312. The samples were forwarded to the Cinnaminson laboratory for analysis.

On October 31st, all samples that had not been previously deemed overloaded were reported.

Unlike asbestos analysis of building materials, analysis of samples from sites with naturally occurring asbestos have the added complexity of the potential presence of non-regulated asbestiform and other naturally fibrous minerals. The U.S. Occupational Safety and Health Administration (OSHA) and the U.S. Environmental Protection Agency (EPA) have regulated asbestos since the early 1970s. The current regulations specify chrysotile and the asbestiform habit of five amphiboles: tremolite, actinolite, anthophyllite, riebeckite (listed as crocidolite) and cummingtonite-grunerite (listed as amosite) (Title 40, Code of Federal Regulations, Part 61 and Part 763; Title 29, Code of Federal Regulations, Part 1910 and Part 1926). These minerals were known at the time the regulations were first written to have been mined commercially as asbestos. Although there have been modifications to the regulations since they were first promulgated, most notably to clarify that cleavage fragments are not asbestos (Federal Register 1992), the minerals that are regulated have not changed. In particular, the sodic-calcic amphiboles Winchite and Richterite, which are present in many areas, but gained notoriety at the Libby, Montana superfund site, are not regulated amphiboles. While the distinctions among amphiboles are important from a scientific standpoint, they do not add significantly to the regulatory terminology unless they are correlated with risk assessment. There are epidemiological data that show differences in disease potential among different minerals with similar morphology. For the purposes of this study, asbestiform Non-Regulated Amphibole fibers were identified, but not included in the asbestos concentrations.

Quality Control Performed
The Quality Control (QC) and equipment calibrations were performed in compliance with EMSL's Quality Assurance Manual. All QC results presented within this package were found to be concordant.

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. Release of the data contained in this data package has been authorized by the Laboratory Manager(s) or his designee, as verified by the following signature(s).

Robyn Denton

11/23/12
Date

Robyn Denton
Asbestos Laboratory Manager
EMSL Cinnaminson, NJ

2. Tabulated Sample Results

EMSL

Attention: Samantha Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
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Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/18/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0001	
Customer Sample #:		HM-MS RS-01	
Date sampled:		9/4/2012	
Initials of Analyst:		KD	
Air volume:		846	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0186	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0117	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0186	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0117	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0186**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0002	
Customer Sample #:		HM-MS RS-02	
Date sampled:		9/4/2012	
Initials of Analyst:		KD	
Air volume:		798	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0112	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0112	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0112	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0112	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0112**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0003	
Customer Sample #:		HM-MS RS-03	
Date sampled:		9/4/2012	
Initials of Analyst:		KD	
Air volume:		609	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		13	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0113	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0113	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0113	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0113	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0113**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0004	
Customer Sample #:		HM-MS RS-04	
Date sampled:		9/4/2012	
Initials of Analyst:		KD	
Air volume:		860	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0115	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0115	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0115	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0115	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0115**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

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Analysis Date: 9/19/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0005	
Customer Sample #:		HM-MS HK-01	
Date sampled:		9/5/2012	
Initials of Analyst:		KD	
Air volume:		708	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		7	
Number of total asbestos structures counted:		7	
Number of Asbestos Structures > 5 microns:		7	
Number of Asbestos fibers and bundles > 5 microns:		7	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:		0.0268	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0115	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0108	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0553	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0115	Structure/cc
Concentration of Asbestos (total):		**0.0268**	**Structure/cc**

Comments:
None

Robyn Denton
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0006	
Customer Sample #:		HM-MS HK-02	
Date sampled:		9/5/2012	
Initials of Analyst:		KD	
Air volume:		705	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0182	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0115	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0182	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0115	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0182**	**Structure/cc**

Comments:
None

Robyn Denton
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EMSL Order: 091211943
Analysis Date: 9/19/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0007	
Customer Sample #:		HM-MS HK-03	
Date sampled:		9/5/2012	
Initials of Analyst:		KD	
Air volume:		671	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		2	
Number of total asbestos structures counted:		2	
Number of Asbestos Structures > 5 microns:		2	
Number of Asbestos fibers and bundles > 5 microns:		2	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		2	
Concentration of Chrysotile Asbestos:	<	0.0234	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0111	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0234	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0111	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0234**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/19/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0008	
Customer Sample #:		HM-MS HK-04	
Date sampled:		9/5/2012	
Initials of Analyst:		KD	
Air volume:		713	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0180	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0114	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0180	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0114	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0180**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0009	
Customer Sample #:		HM-MS ATV-01	
Date sampled:		9/5/2012	
Initials of Analyst:		FC	
Air volume:		646	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		35	
Number of total asbestos structures counted:		37	
Number of Asbestos Structures > 5 microns:		35	
Number of Asbestos fibers and bundles > 5 microns:		37	
Number of PCM equivalent asbestos structures:		8	
Number of PCM equivalent asbestos fibers:		24	
Concentration of Chrysotile Asbestos:		0.0808	Structure/cc
Concentration of Amphibole Asbestos:		0.0654	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0500	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1236	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0381	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.1048	Structure/cc
Concentration of Asbestos (total):		**0.1463**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

EMSL

Attention: Samantha Knight
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Customer ID: ERRG25
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EMSL Order: 091211943
Analysis Date: 11/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0010	
Customer Sample #:		HM-MS ATV-02	
Date sampled:		9/5/2012	
Initials of Analyst:		RD	
Air volume:		630	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm^2
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		46	
Number of total asbestos structures counted:		48	
Number of Asbestos Structures > 5 microns:		46	
Number of Asbestos fibers and bundles > 5 microns:		48	
Number of PCM equivalent asbestos structures:		24	
Number of PCM equivalent asbestos fibers:		37	
Concentration of Chrysotile Asbestos:		0.1543	Structure/cc
Concentration of Amphibole Asbestos:		0.0309	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.1102	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.2101	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0133	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0608	Structure/cc
Concentration of Asbestos (total):		**0.1852**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton
Approved Signatory

EMSL

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Customer ID: ERRG25
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EMSL Order: 091211943
Analysis Date: 11/14/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0011	
Customer Sample #:		HM-MS ATV-03	
Date sampled:		9/5/2012	
Initials of Analyst:		LM	
Air volume:		722	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		39	
Number of total asbestos structures counted:		53	
Number of Asbestos Structures > 5 microns:		39	
Number of Asbestos fibers and bundles > 5 microns:		53	
Number of PCM equivalent asbestos structures:		6	
Number of PCM equivalent asbestos fibers:		44	
Concentration of Chrysotile Asbestos:		0.1726	Structure/cc
Concentration of Amphibole Asbestos:		0.0220	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.1268	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.2295	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0081	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0480	Structure/cc
Concentration of Asbestos (total):		**0.1946**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton
Approved Signatory

EMSL

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Customer ID: ERRG25
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Analysis Date: 10/31/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0012	
Customer Sample #:		HM-MS ATV-04	
Date sampled:		9/5/2012	
Initials of Analyst:		PH	
Air volume:		704	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		47	
Number of total asbestos structures counted:		52	
Number of Asbestos Structures > 5 microns:		48	
Number of Asbestos fibers and bundles > 5 microns:		52	
Number of PCM equivalent asbestos structures:		23	
Number of PCM equivalent asbestos fibers:		52	
Concentration of Chrysotile Asbestos:		0.1426	Structure/cc
Concentration of Amphibole Asbestos:		0.0578	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.1004	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1966	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0324	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0954	Structure/cc
Concentration of Asbestos (total):		**0.2004**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample. Revised 11/19/12

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Knight
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4585 Pacheco Blvd.
Suite 200
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Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/27/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0013	
Customer Sample #:		HM-MS ATV-05	
Date sampled:		9/5/2012	
Initials of Analyst:		FC	
Air volume:		723	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		24	
Number of total asbestos structures counted:		25	
Number of Asbestos Structures > 5 microns:		24	
Number of Asbestos fibers and bundles > 5 microns:		24	
Number of PCM equivalent asbestos structures:		11	
Number of PCM equivalent asbestos fibers:		22	
Concentration of Chrysotile Asbestos:		0.0477	Structure/cc
Concentration of Amphibole Asbestos:		0.0440	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0254	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0815	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0227	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0769	Structure/cc
Concentration of Asbestos (total):		**0.0917**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/20/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0014	
Customer Sample #:		HM-MS MB-01	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		544	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		14	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		3	
Number of total asbestos structures counted:		3	
Number of Asbestos Structures > 5 microns:		3	
Number of Asbestos fibers and bundles > 5 microns:		3	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		3	
Concentration of Chrysotile Asbestos:		0.0304	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0117	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0024	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0304	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0117	Structure/cc
Concentration of Asbestos (total):		**0.0304**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/20/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0015	
Customer Sample #:		HM-MS MB-02	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		580	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		13	
Analytical Sensitivity:		0.0040	Structure/cc
Number of Primary Asbestos Structures Counted:		3	
Number of total asbestos structures counted:		3	
Number of Asbestos Structures > 5 microns:		3	
Number of Asbestos fibers and bundles > 5 microns:		3	
Number of PCM equivalent asbestos structures:		2	
Number of PCM equivalent asbestos fibers:		2	
Concentration of Chrysotile Asbestos:		0.0307	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0118	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0025	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0307	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0118	Structure/cc
Concentration of Asbestos (total):		**0.0307**	**Structure/cc**

Comments:
None

Robyn Denton
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EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/20/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0016	
Customer Sample #:		HM-MS MB-03	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		688	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		13	
Number of total asbestos structures counted:		13	
Number of Asbestos Structures > 5 microns:		13	
Number of Asbestos fibers and bundles > 5 microns:		13	
Number of PCM equivalent asbestos structures:		9	
Number of PCM equivalent asbestos fibers:		9	
Concentration of Chrysotile Asbestos:		0.0513	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0118	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0273	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0877	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0118	Structure/cc
Concentration of Asbestos (total):		**0.0513**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/22/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0017	
Customer Sample #:		HM-MS MB-04	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		675	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		25	
Number of total asbestos structures counted:		25	
Number of Asbestos Structures > 5 microns:		25	
Number of Asbestos fibers and bundles > 5 microns:		25	
Number of PCM equivalent asbestos structures:		22	
Number of PCM equivalent asbestos fibers:		23	
Concentration of Chrysotile Asbestos:		0.0884	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0175	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0567	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1316	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0175	Structure/cc
Concentration of Asbestos (total):		**0.0884**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/23/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0018	
Customer Sample #:		HM-MS AA-05	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		1717	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0019	Structure/cc
Number of Primary Asbestos Structures Counted:		14	
Number of total asbestos structures counted:		14	
Number of Asbestos Structures > 5 microns:		14	
Number of Asbestos fibers and bundles > 5 microns:		14	
Number of PCM equivalent asbestos structures:		9	
Number of PCM equivalent asbestos fibers:		10	
Concentration of Chrysotile Asbestos:		0.0270	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0058	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0148	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0454	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0058	Structure/cc
Concentration of Asbestos (total):		**0.0270**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/25/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0019	
Customer Sample #:		HM-MS AA-06	
Date sampled:		9/9/2012	
Initials of Analyst:		KD	
Air volume:		1694	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0020	Structure/cc
Number of Primary Asbestos Structures Counted:		6	
Number of total asbestos structures counted:		6	
Number of Asbestos Structures > 5 microns:		6	
Number of Asbestos fibers and bundles > 5 microns:		6	
Number of PCM equivalent asbestos structures:		6	
Number of PCM equivalent asbestos fibers:		6	
Concentration of Chrysotile Asbestos:		0.0117	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0059	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0043	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0256	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0059	Structure/cc
Concentration of Asbestos (total):		**0.0117**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/7/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0020	
Customer Sample #:		HM-AP ATV-01	
Date sampled:		9/6/2012	
Initials of Analyst:		FC	
Air volume:		595	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		13	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		9	
Number of total asbestos structures counted:		10	
Number of Asbestos Structures > 5 microns:		9	
Number of Asbestos fibers and bundles > 5 microns:		10	
Number of PCM equivalent asbestos structures:		5	
Number of PCM equivalent asbestos fibers:		10	
Concentration of Chrysotile Asbestos:		0.0232	Structure/cc
Concentration of Amphibole Asbestos:		0.0154	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0085	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0504	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0042	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0395	Structure/cc
Concentration of Asbestos (total):		**0.0386**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton
Approved Signatory

EMSL

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Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/12/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0021	
Customer Sample #:		HM-AP ATV-02	
Date sampled:		9/6/2012	
Initials of Analyst:		FC	
Air volume:		660	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm^2
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		30	
Number of total asbestos structures counted:		33	
Number of Asbestos Structures > 5 microns:		30	
Number of Asbestos fibers and bundles > 5 microns:		33	
Number of PCM equivalent asbestos structures:		6	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:		0.0994	Structure/cc
Concentration of Amphibole Asbestos:		0.0221	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0655	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1447	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0081	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0481	Structure/cc
Concentration of Asbestos (total):		**0.1215**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/2/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0022	
Customer Sample #:		HM-AP ATV-03	
Date sampled:		9/6/2012	
Initials of Analyst:		PH	
Air volume:		568	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm^2
Number of Grid Openings Analyzed:		14	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		43	
Number of total asbestos structures counted:		49	
Number of Asbestos Structures > 5 microns:		43	
Number of Asbestos fibers and bundles > 5 microns:		49	
Number of PCM equivalent asbestos structures:		31	
Number of PCM equivalent asbestos fibers:		50	
Concentration of Chrysotile Asbestos:		0.1247	Structure/cc
Concentration of Amphibole Asbestos:		0.0550	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0864	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1743	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0308	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0907	Structure/cc
Concentration of Asbestos (total):		**0.1797**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/6/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0023	
Customer Sample #:		HM-AP ATV-04	
Date sampled:		9/6/2012	
Initials of Analyst:		PH	
Air volume:		662	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		11	
Number of total asbestos structures counted:		11	
Number of Asbestos Structures > 5 microns:		11	
Number of Asbestos fibers and bundles > 5 microns:		11	
Number of PCM equivalent asbestos structures:		7	
Number of PCM equivalent asbestos fibers:		11	
Concentration of Chrysotile Asbestos:		0.0301	Structure/cc
Concentration of Amphibole Asbestos:		0.0150	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0130	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0592	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0041	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0385	Structure/cc
Concentration of Asbestos (total):		**0.0451**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/5/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0024	
Customer Sample #:		HM-AP MB-01	
Date sampled:		9/10/2012	
Initials of Analyst:		FC	
Air volume:		792	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		11	
Number of total asbestos structures counted:		11	
Number of Asbestos Structures > 5 microns:		11	
Number of Asbestos fibers and bundles > 5 microns:		11	
Number of PCM equivalent asbestos structures:		8	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:		0.0188	Structure/cc
Concentration of Amphibole Asbestos:		0.0226	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0061	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0440	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0083	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0492	Structure/cc
Concentration of Asbestos (total):		**0.0415**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/25/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0025	
Customer Sample #:		HM-AP MB-02	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		786	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		17	
Number of total asbestos structures counted:		17	
Number of Asbestos Structures > 5 microns:		17	
Number of Asbestos fibers and bundles > 5 microns:		17	
Number of PCM equivalent asbestos structures:		16	
Number of PCM equivalent asbestos fibers:		16	
Concentration of Chrysotile Asbestos:		0.0646	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0114	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0376	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1034	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0114	Structure/cc
Concentration of Asbestos (total):		**0.0646**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Knight
Engineering/Remediation Resources Group
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Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/26/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0026	
Customer Sample #:		HM-AP MB-03	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		730	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		15	
Number of total asbestos structures counted:		15	
Number of Asbestos Structures > 5 microns:		15	
Number of Asbestos fibers and bundles > 5 microns:		15	
Number of PCM equivalent asbestos structures:		12	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0520	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0176	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0284	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0873	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0176	Structure/cc
Concentration of Asbestos (total):		**0.0520**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/26/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0027	
Customer Sample #:		HM-AP MB-04	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		705	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		15	
Number of total asbestos structures counted:		15	
Number of Asbestos Structures > 5 microns:		15	
Number of Asbestos fibers and bundles > 5 microns:		15	
Number of PCM equivalent asbestos structures:		12	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0577	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0115	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0323	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0952	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0115	Structure/cc
Concentration of Asbestos (total):		**0.0577**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Knight
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Suite 200
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/27/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0028	
Customer Sample #:		HM-AP MB-05	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		600	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		14	
Analytical Sensitivity:		0.0036	Structure/cc
Number of Primary Asbestos Structures Counted:		19	
Number of total asbestos structures counted:		19	
Number of Asbestos Structures > 5 microns:		19	
Number of Asbestos fibers and bundles > 5 microns:		19	
Number of PCM equivalent asbestos structures:		17	
Number of PCM equivalent asbestos fibers:		19	
Concentration of Chrysotile Asbestos:		0.0568	Structure/cc
Concentration of Amphibole Asbestos:		0.0275	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0325	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0923	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0022	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0275	Structure/cc
Concentration of Asbestos (total):		**0.0844**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 9/30/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0029	
Customer Sample #:		HM-AP HK-01	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		710	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		21	
Number of total asbestos structures counted:		21	
Number of Asbestos Structures > 5 microns:		21	
Number of Asbestos fibers and bundles > 5 microns:		21	
Number of PCM equivalent asbestos structures:		11	
Number of PCM equivalent asbestos fibers:		13	
Concentration of Chrysotile Asbestos:		0.0802	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0114	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0497	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1227	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0114	Structure/cc
Concentration of Asbestos (total):		**0.0802**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/3/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0030	
Customer Sample #:		HM-AP HK-02	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		707	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0035	Structure/cc
Number of Primary Asbestos Structures Counted:		32	
Number of total asbestos structures counted:		32	
Number of Asbestos Structures > 5 microns:		32	
Number of Asbestos fibers and bundles > 5 microns:		32	
Number of PCM equivalent asbestos structures:		27	
Number of PCM equivalent asbestos fibers:		28	
Concentration of Chrysotile Asbestos:		0.1091	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0167	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0741	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1548	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0167	Structure/cc
Concentration of Asbestos (total):		**0.1091**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/3/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0031	
Customer Sample #:		HM-AP HK-03	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		668	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		12	
Number of total asbestos structures counted:		12	
Number of Asbestos Structures > 5 microns:		12	
Number of Asbestos fibers and bundles > 5 microns:		12	
Number of PCM equivalent asbestos structures:		10	
Number of PCM equivalent asbestos fibers:		11	
Concentration of Chrysotile Asbestos:		0.0447	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0111	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0231	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0780	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0111	Structure/cc
Concentration of Asbestos (total):		**0.0447**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Knight
Engineering/Remediation Resources Group
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Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0032	
Customer Sample #:		HM-AP HK-04	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		685	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0036	Structure/cc
Number of Primary Asbestos Structures Counted:		26	
Number of total asbestos structures counted:		26	
Number of Asbestos Structures > 5 microns:		26	
Number of Asbestos fibers and bundles > 5 microns:		26	
Number of PCM equivalent asbestos structures:		15	
Number of PCM equivalent asbestos fibers:		20	
Concentration of Chrysotile Asbestos:		0.0908	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0172	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0587	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1340	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0172	Structure/cc
Concentration of Asbestos (total):		**0.0908**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Knight
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Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0033	
Customer Sample #:		HM-AP HK-05	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		735	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		11	
Number of total asbestos structures counted:		11	
Number of Asbestos Structures > 5 microns:		11	
Number of Asbestos fibers and bundles > 5 microns:		11	
Number of PCM equivalent asbestos structures:		8	
Number of PCM equivalent asbestos fibers:		8	
Concentration of Chrysotile Asbestos:		0.0295	Structure/cc
Concentration of Amphibole Asbestos:		0.0286	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0128	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0582	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0023	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0286	Structure/cc
Concentration of Asbestos (total):		**0.0581**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0034	
Customer Sample #:		HM-AP AA-03	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		1925	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		8	
Analytical Sensitivity:		0.0019	Structure/cc
Number of Primary Asbestos Structures Counted:		6	
Number of total asbestos structures counted:		6	
Number of Asbestos Structures > 5 microns:		6	
Number of Asbestos fibers and bundles > 5 microns:		6	
Number of PCM equivalent asbestos structures:		5	
Number of PCM equivalent asbestos fibers:		5	
Concentration of Chrysotile Asbestos:		0.0116	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0058	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0043	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0253	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0058	Structure/cc
Concentration of Asbestos (total):		**0.0116**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0035	
Customer Sample #:		HM-AP AA-04	
Date sampled:		9/10/2012	
Initials of Analyst:		KD	
Air volume:		1919	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		8	
Analytical Sensitivity:		0.0019	Structure/cc
Number of Primary Asbestos Structures Counted:		15	
Number of total asbestos structures counted:		15	
Number of Asbestos Structures > 5 microns:		15	
Number of Asbestos fibers and bundles > 5 microns:		15	
Number of PCM equivalent asbestos structures:		11	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0253	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0122	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0135	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0432	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0122	Structure/cc
Concentration of Asbestos (total):		**0.0253**	**Structure/cc**

Comments:
Actinolite

Robyn Denton

Approved Signatory

EMSL

Attention: Samantha Knight
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Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/13/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0036	
Customer Sample #:		HM-OP ATV-01	
Date sampled:		9/7/2012	
Initials of Analyst:		PH	
Air volume:		673	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0036	Structure/cc
Number of Primary Asbestos Structures Counted:		13	
Number of total asbestos structures counted:		13	
Number of Asbestos Structures > 5 microns:		13	
Number of Asbestos fibers and bundles > 5 microns:		13	
Number of PCM equivalent asbestos structures:		9	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0397	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0228	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0198	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0711	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0228	Structure/cc
Concentration of Asbestos (total):		**0.0397**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/9/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0037	
Customer Sample #:		HM-OP ATV-02	
Date sampled:		9/7/2012	
Initials of Analyst:		FC	
Air volume:		616	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0053	Structure/cc
Number of Primary Asbestos Structures Counted:		16	
Number of total asbestos structures counted:		16	
Number of Asbestos Structures > 5 microns:		16	
Number of Asbestos fibers and bundles > 5 microns:		16	
Number of PCM equivalent asbestos structures:		2	
Number of PCM equivalent asbestos fibers:		9	
Concentration of Chrysotile Asbestos:		0.0421	Structure/cc
Concentration of Amphibole Asbestos:		0.0421	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0182	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0829	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0182	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0829	Structure/cc
Concentration of Asbestos (total):		**0.0842**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton
Approved Signatory

EMSL

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Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/1/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0038	
Customer Sample #:		HM-OP ATV-03	
Date sampled:		9/7/2012	
Initials of Analyst:		FC	
Air volume:		695	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		17	
Number of total asbestos structures counted:		20	
Number of Asbestos Structures > 5 microns:		15	
Number of Asbestos fibers and bundles > 5 microns:		20	
Number of PCM equivalent asbestos structures:		2	
Number of PCM equivalent asbestos fibers:		19	
Concentration of Chrysotile Asbestos:		0.0649	Structure/cc
Concentration of Amphibole Asbestos:		0.0296	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0378	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1038	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0024	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0296	Structure/cc
Concentration of Asbestos (total):		**0.0944**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton
Approved Signatory

EMSL

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/6/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0039	
Customer Sample #:		HM-OP ATV-04	
Date sampled:		9/7/2012	
Initials of Analyst:		PH	
Air volume:		736	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		13	
Number of total asbestos structures counted:		13	
Number of Asbestos Structures > 5 microns:		13	
Number of Asbestos fibers and bundles > 5 microns:		13	
Number of PCM equivalent asbestos structures:		7	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0479	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0110	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0255	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0820	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0110	Structure/cc
Concentration of Asbestos (total):		**0.0479**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Non-Regulated Amphibole present in sample.

Robyn Denton
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Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/9/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0040	
Customer Sample #:		HM-OP ATV-05	
Date sampled:		9/7/2012	
Initials of Analyst:		FC	
Air volume:		694	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		17	
Number of total asbestos structures counted:		18	
Number of Asbestos Structures > 5 microns:		17	
Number of Asbestos fibers and bundles > 5 microns:		18	
Number of PCM equivalent asbestos structures:		5	
Number of PCM equivalent asbestos fibers:		10	
Concentration of Chrysotile Asbestos:		0.0688	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0114	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0408	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1087	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0114	Structure/cc
Concentration of Asbestos (total):		**0.0688**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Non-Regulated Amphibole present in sample.

Robyn Denton
Approved Signatory

EMSL

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Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/2/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0041	
Customer Sample #:		HM-OP MB-01	
Date sampled:		9/7/2012	
Initials of Analyst:		FC	
Air volume:		733	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0036	Structure/cc
Number of Primary Asbestos Structures Counted:		8	
Number of total asbestos structures counted:		11	
Number of Asbestos Structures > 5 microns:		8	
Number of Asbestos fibers and bundles > 5 microns:		11	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		8	
Concentration of Chrysotile Asbestos:		0.0326	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0228	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0149	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0618	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0228	Structure/cc
Concentration of Asbestos (total):		**0.0326**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton
Approved Signatory

EMSL

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/4/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0042	
Customer Sample #:		HM-OP MB-02	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		696	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		17	
Number of total asbestos structures counted:		17	
Number of Asbestos Structures > 5 microns;		17	
Number of Asbestos fibers and bundles > 5 microns:		17	
Number of PCM equivalent asbestos structures:		16	
Number of PCM equivalent asbestos fibers:		16	
Concentration of Chrysotile Asbestos:		0.0546	Structure/cc
Concentration of Amphibole Asbestos:		0.0302	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0298	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0916	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0024	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0302	Structure/cc
Concentration of Asbestos (total):		**0.0848**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/7/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0043	
Customer Sample #:		HM-OP MB-03	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		726	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		39	
Number of total asbestos structures counted:		39	
Number of Asbestos Structures > 5 microns:		39	
Number of Asbestos fibers and bundles > 5 microns:		39	
Number of PCM equivalent asbestos structures:		29	
Number of PCM equivalent asbestos fibers:		31	
Concentration of Chrysotile Asbestos:		0.1420	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0177	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.1005	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1949	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0177	Structure/cc
Concentration of Asbestos (total):		**0.1420**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 11/5/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0044	
Customer Sample #:		HM-OP MB-04	
Date sampled:		9/7/2012	
Initials of Analyst:		PH	
Air volume:		768	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		7	
Number of total asbestos structures counted:		8	
Number of Asbestos Structures > 5 microns:		7	
Number of Asbestos fibers and bundles > 5 microns:		8	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		8	
Concentration of Chrysotile Asbestos:		0.0194	Structure/cc
Concentration of Amphibole Asbestos:		0.0301	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0063	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0453	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0024	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0301	Structure/cc
Concentration of Asbestos (total):		**0.0495**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/7/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0045	
Customer Sample #:		HM-OP HK-01	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		726	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		21	
Number of total asbestos structures counted:		21	
Number of Asbestos Structures > 5 microns:		21	
Number of Asbestos fibers and bundles > 5 microns:		21	
Number of PCM equivalent asbestos structures:		12	
Number of PCM equivalent asbestos fibers:		14	
Concentration of Chrysotile Asbestos:		0.0673	Structure/cc
Concentration of Amphibole Asbestos:		0.0290	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0399	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1063	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0023	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0290	Structure/cc
Concentration of Asbestos (total):		**0.0962**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/7/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0046	
Customer Sample #:		HM-OP HK-02	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		772	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		22	
Number of total asbestos structures counted:		22	
Number of Asbestos Structures > 5 microns:		22	
Number of Asbestos fibers and bundles > 5 microns:		22	
Number of PCM equivalent asbestos structures:		17	
Number of PCM equivalent asbestos fibers:		18	
Concentration of Chrysotile Asbestos:		0.0812	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0183	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0503	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1241	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0183	Structure/cc
Concentration of Asbestos (total):		**0.0812**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
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EMSL

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Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/8/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0047	
Customer Sample #:		HM-OP HK-03	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		717	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		7	
Number of total asbestos structures counted:		7	
Number of Asbestos Structures > 5 microns:		7	
Number of Asbestos fibers and bundles > 5 microns:		7	
Number of PCM equivalent asbestos structures:		7	
Number of PCM equivalent asbestos fibers:		7	
Concentration of Chrysotile Asbestos:		0.0189	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0238	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0061	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0442	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0238	Structure/cc
Concentration of Asbestos (total):		**0.0238**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
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Customer ID: ERRG25
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Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/8/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0048	
Customer Sample #:		HM-OP HK-04	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		726	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		5	
Number of total asbestos structures counted:		5	
Number of Asbestos Structures > 5 microns:		5	
Number of Asbestos fibers and bundles > 5 microns:		5	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		3	
Concentration of Chrysotile Asbestos:		0.0187	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0112	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0061	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0436	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0112	Structure/cc
Concentration of Asbestos (total):		**0.0187**	**Structure/cc**

Comments:
None

Robyn Denton

Approved Signatory

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Customer ID: ERRG25
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Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/8/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0049	
Customer Sample #:		HM-OP HK-05	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		654	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		14	
Number of total asbestos structures counted:		14	
Number of Asbestos Structures > 5 microns:		14	
Number of Asbestos fibers and bundles > 5 microns:		14	
Number of PCM equivalent asbestos structures:		7	
Number of PCM equivalent asbestos fibers:		7	
Concentration of Chrysotile Asbestos:		0.0418	Structure/cc
Concentration of Amphibole Asbestos:		0.0295	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0209	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0749	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0024	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0295	Structure/cc
Concentration of Asbestos (total):		**0.0713**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/8/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0050	
Customer Sample #:		HM-OP RS-01	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		760	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		3	
Number of total asbestos structures counted:		3	
Number of Asbestos Structures > 5 microns:		3	
Number of Asbestos fibers and bundles > 5 microns:		3	
Number of PCM equivalent asbestos structures:		2	
Number of PCM equivalent asbestos fibers:		2	
Concentration of Chrysotile Asbestos:		0.0304	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0117	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0024	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0304	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0117	Structure/cc
Concentration of Asbestos (total):		**0.0304**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0051	
Customer Sample #:		HM-OP RS-02	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		737	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		14	
Number of total asbestos structures counted:		14	
Number of Asbestos Structures > 5 microns:		14	
Number of Asbestos fibers and bundles > 5 microns:		14	
Number of PCM equivalent asbestos structures:		12	
Number of PCM equivalent asbestos fibers:		13	
Concentration of Chrysotile Asbestos:		0.0515	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0110	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0282	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0865	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0110	Structure/cc
Concentration of Asbestos (total):		**0.0515**	**Structure/cc**

Comments:
None

Robyn Denton
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Customer ID: ERRG25
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Analysis Date: 10/9/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0052	
Customer Sample #:		HM-OP RS-03	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		735	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		17	
Number of total asbestos structures counted:		17	
Number of Asbestos Structures > 5 microns:		17	
Number of Asbestos fibers and bundles > 5 microns:		17	
Number of PCM equivalent asbestos structures:		12	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0554	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0233	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0310	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0913	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0233	Structure/cc
Concentration of Asbestos (total):		**0.0554**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0053	
Customer Sample #:		HM-OP RS-04	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		797	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		18	
Number of total asbestos structures counted:		18	
Number of Asbestos Structures > 5 microns:		18	
Number of Asbestos fibers and bundles > 5 microns:		18	
Number of PCM equivalent asbestos structures:		11	
Number of PCM equivalent asbestos fibers:		14	
Concentration of Chrysotile Asbestos:		0.0599	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0236	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0342	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0973	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0236	Structure/cc
Concentration of Asbestos (total):		**0.0599**	**Structure/cc**

Comments:
Actinolite

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0054	
Customer Sample #:		HM-OP RS-05	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		723	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		4	
Number of total asbestos structures counted:		4	
Number of Asbestos Structures > 5 microns:		4	
Number of Asbestos fibers and bundles > 5 microns:		4	
Number of PCM equivalent asbestos structures:		4	
Number of PCM equivalent asbestos fibers:		4	
Concentration of Chrysotile Asbestos:		0.0150	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0112	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0041	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0384	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0112	Structure/cc
Concentration of Asbestos (total):		**0.0150**	**Structure/cc**

Comments:
None

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Customer ID: ERRG25
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0055	
Customer Sample #:		HM-OP AA-01	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		1589	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0019	Structure/cc
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0056	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0056	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0056	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0056	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0056**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0056	
Customer Sample #:		HM-OP AA-02	
Date sampled:		9/7/2012	
Initials of Analyst:		KD	
Air volume:		1657	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0020	Structure/cc
Number of Primary Asbestos Structures Counted:		2	
Number of total asbestos structures counted:		2	
Number of Asbestos Structures > 5 microns:		2	
Number of Asbestos fibers and bundles > 5 microns:		2	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:	<	0.0126	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0060	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0126	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0060	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0126**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
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Analysis Date: 11/9/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0057	
Customer Sample #:		HM-BG ATV-01	
Date sampled:		9/9/2012	
Initials of Analyst:		FC	
Air volume:		720	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		20	
Number of total asbestos structures counted:		21	
Number of Asbestos Structures > 5 microns:		20	
Number of Asbestos fibers and bundles > 5 microns:		21	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		13	
Concentration of Chrysotile Asbestos:		0.0626	Structure/cc
Concentration of Amphibole Asbestos:		0.0147	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0365	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1002	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0040	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0377	Structure/cc
Concentration of Asbestos (total):		**0.0773**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton

Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
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EMSL Order: 091211943
Analysis Date: 11/12/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0058	
Customer Sample #:		HM-BG ATV-02	
Date sampled:		9/9/2012	
Initials of Analyst:		CC	
Air volume:		582	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0073	mm²
Number of Grid Openings Analyzed:		23	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		36	
Number of total asbestos structures counted:		39	
Number of Asbestos Structures > 5 microns:		36	
Number of Asbestos fibers and bundles > 5 microns:		39	
Number of PCM equivalent asbestos structures:		13	
Number of PCM equivalent asbestos fibers:		39	
Concentration of Chrysotile Asbestos:		0.1300	Structure/cc
Concentration of Amphibole Asbestos:		0.0236	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0895	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1826	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0087	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0515	Structure/cc
Concentration of Asbestos (total):		**0.1537**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton
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Customer ID: ERRG25
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EMSL Order: 091211943
Analysis Date: 11/14/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0059	
Customer Sample #:		HM-BG ATV-03	
Date sampled:		9/9/2012	
Initials of Analyst:		DC	
Air volume:		615	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0073	mm²
Number of Grid Openings Analyzed:		22	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		35	
Number of total asbestos structures counted:		38	
Number of Asbestos Structures > 5 microns:		35	
Number of Asbestos fibers and bundles > 5 microns:		38	
Number of PCM equivalent asbestos structures:		17	
Number of PCM equivalent asbestos fibers:		38	
Concentration of Chrysotile Asbestos:		0.1247	Structure/cc
Concentration of Amphibole Asbestos:		0.0234	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0853	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1761	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0086	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0509	Structure/cc
Concentration of Asbestos (total):		**0.1481**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

Robyn Denton

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Customer ID: ERRG25
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Analysis Date: 11/16/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0060	
Customer Sample #:		HM-BG ATV-04	
Date sampled:		9/9/2012	
Initials of Analyst:		FC	
Air volume:		660	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		12	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		13	
Number of total asbestos structures counted:		14	
Number of Asbestos Structures > 5 microns:		13	
Number of Asbestos fibers and bundles > 5 microns:		14	
Number of PCM equivalent asbestos structures:		2	
Number of PCM equivalent asbestos fibers:		12	
Concentration of Chrysotile Asbestos:		0.0368	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0175	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0177	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0677	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0175	Structure/cc
Concentration of Asbestos (total):		**0.0368**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite present in sample.

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0061	
Customer Sample #:		HM-BG MB-01	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		765	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0185	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0117	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0185	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0117	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0185**	**Structure/cc**

Comments:
None

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Analysis Date: 10/9/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0062	
Customer Sample #:		HM-BG MB-02	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		758	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		23	
Number of total asbestos structures counted:		23	
Number of Asbestos Structures > 5 microns:		23	
Number of Asbestos fibers and bundles > 5 microns:		23	
Number of PCM equivalent asbestos structures:		18	
Number of PCM equivalent asbestos fibers:		18	
Concentration of Chrysotile Asbestos:		0.0630	Structure/cc
Concentration of Amphibole Asbestos:		0.0276	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0360	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1023	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0111	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0568	Structure/cc
Concentration of Asbestos (total):		**0.0906**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

Attention: Samantha Knight
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Project: 2011-189

Customer ID: ERRG25
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0063	
Customer Sample #:		HM-BG MB-03	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		693	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0039	Structure/cc
Number of Primary Asbestos Structures Counted:		2	
Number of total asbestos structures counted:		2	
Number of Asbestos Structures > 5 microns:		2	
Number of Asbestos fibers and bundles > 5 microns:		2	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		2	
Concentration of Chrysotile Asbestos:	<	0.0247	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0117	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0247	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0117	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0247**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Analysis Date: 10/10/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0064	
Customer Sample #:		HM-BG MB-04	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		684	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0040	Structure/cc
Number of Primary Asbestos Structures Counted:		16	
Number of total asbestos structures counted:		16	
Number of Asbestos Structures > 5 microns:		16	
Number of Asbestos fibers and bundles > 5 microns:		16	
Number of PCM equivalent asbestos structures:		8	
Number of PCM equivalent asbestos fibers:		10	
Concentration of Chrysotile Asbestos:		0.0635	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0119	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0363	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.1031	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0119	Structure/cc
Concentration of Asbestos (total):		**0.0635**	**Structure/cc**

Comments:
None

Robyn Denton
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0065	
Customer Sample #:		HM-BG HK-01	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		733	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		4	
Number of total asbestos structures counted:		4	
Number of Asbestos Structures > 5 microns:		4	
Number of Asbestos fibers and bundles > 5 microns:		4	
Number of PCM equivalent asbestos structures:		4	
Number of PCM equivalent asbestos fibers:		4	
Concentration of Chrysotile Asbestos:	<	0.0233	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0233	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0233	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0233	Structure/cc
Concentration of Asbestos (total):		**0.0233**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0066	
Customer Sample #:		HM-BG HK-02	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		810	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		4	
Number of total asbestos structures counted:		4	
Number of Asbestos Structures > 5 microns:		4	
Number of Asbestos fibers and bundles > 5 microns:		4	
Number of PCM equivalent asbestos structures:		4	
Number of PCM equivalent asbestos fibers:		4	
Concentration of Chrysotile Asbestos:		0.0147	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0110	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0040	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0377	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0110	Structure/cc
Concentration of Asbestos (total):		**0.0147**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Analysis Date: 10/10/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0067	
Customer Sample #:		HM-BG HK-03	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		724	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0037	Structure/cc
Number of Primary Asbestos Structures Counted:		22	
Number of total asbestos structures counted:		22	
Number of Asbestos Structures > 5 microns:		22	
Number of Asbestos fibers and bundles > 5 microns:		22	
Number of PCM equivalent asbestos structures:		14	
Number of PCM equivalent asbestos fibers:		17	
Concentration of Chrysotile Asbestos:		0.0600	Structure/cc
Concentration of Amphibole Asbestos:		0.0225	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0343	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0974	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0083	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0489	Structure/cc
Concentration of Asbestos (total):		**0.0824**	**Structure/cc**

Comments:
Actinolite

Robyn Denton
Approved Signatory

EMSL

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Customer ID: ERRG25
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Analysis Date: 11/15/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0068	
Customer Sample #:		HM-BG HK-04	
Date sampled:		9/11/2012	
Initials of Analyst:		FC	
Air volume:		763	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0132	mm²
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0035	Structure/cc
Number of Primary Asbestos Structures Counted:		10	
Number of total asbestos structures counted:		10	
Number of Asbestos Structures > 5 microns:		10	
Number of Asbestos fibers and bundles > 5 microns:		10	
Number of PCM equivalent asbestos structures:		5	
Number of PCM equivalent asbestos fibers:		8	
Concentration of Chrysotile Asbestos:		0.0209	Structure/cc
Concentration of Amphibole Asbestos:		0.0139	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0077	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0454	Structure/cc
Lower 95% Confidence Limit (Amphibole)		0.0038	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0356	Structure/cc
Concentration of Asbestos (total):		**0.0348**	**Structure/cc**

Comments:
Particulate loading exceeds 10%, analyzed by direct exam at client's request. (Possible low bias) Actinolite and Non-Regulated Amphibole present in sample.

Robyn Denton

Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
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Analysis Date: 10/10/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0069	
Customer Sample #:		HM-BG RS-01	
Date sampled:		9/12/2012	
Initials of Analyst:		KD	
Air volume:		705	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		5	
Number of total asbestos structures counted:		5	
Number of Asbestos Structures > 5 microns:		5	
Number of Asbestos fibers and bundles > 5 microns:		5	
Number of PCM equivalent asbestos structures:		4	
Number of PCM equivalent asbestos fibers:		4	
Concentration of Chrysotile Asbestos:		0.0192	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0115	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0062	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0449	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0115	Structure/cc
Concentration of Asbestos (total):		**0.0192**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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Project: 2011-189

Customer ID: ERRG25
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Analysis Date: 10/10/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0070	
Customer Sample #:		HM-BG RS-02	
Date sampled:		9/12/2012	
Initials of Analyst:		KD	
Air volume:		705	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0038	Structure/cc
Number of Primary Asbestos Structures Counted:		7	
Number of total asbestos structures counted:		7	
Number of Asbestos Structures > 5 microns:		7	
Number of Asbestos fibers and bundles > 5 microns:		7	
Number of PCM equivalent asbestos structures:		4	
Number of PCM equivalent asbestos fibers:		6	
Concentration of Chrysotile Asbestos:		0.0231	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0182	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0085	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0503	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0182	Structure/cc
Concentration of Asbestos (total):		**0.0231**	**Structure/cc**

Comments:
Actinolite

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0071	
Customer Sample #:		HM-BG RS-03	
Date sampled:		9/12/2012	
Initials of Analyst:		KD	
Air volume:		684	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0040	Structure/cc
Number of Primary Asbestos Structures Counted:		3	
Number of total asbestos structures counted:		3	
Number of Asbestos Structures > 5 microns:		3	
Number of Asbestos fibers and bundles > 5 microns:		3	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:		0.0307	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0119	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0025	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0307	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0119	Structure/cc
Concentration of Asbestos (total):		**0.0307**	**Structure/cc**

Comments:
None

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0072	
Customer Sample #:		HM-BG RS-04	
Date sampled:		9/12/2012	
Initials of Analyst:		KD	
Air volume:		678	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		11	
Analytical Sensitivity:		0.0040	Structure/cc
Number of Primary Asbestos Structures Counted:		3	
Number of total asbestos structures counted:		3	
Number of Asbestos Structures > 5 microns:		3	
Number of Asbestos fibers and bundles > 5 microns:		3	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:		0.0310	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0120	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0025	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0310	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0120	Structure/cc
Concentration of Asbestos (total):		**0.0310**	**Structure/cc**

Comments:
None

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0073	
Customer Sample #:		HM-BG AA-01	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		1854	Liters
Area of collection filter:		385	mm²
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm²
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0018	Structure/cc
Number of Primary Asbestos Structures Counted:		6	
Number of total asbestos structures counted:		6	
Number of Asbestos Structures > 5 microns:		6	
Number of Asbestos fibers and bundles > 5 microns:		6	
Number of PCM equivalent asbestos structures:		3	
Number of PCM equivalent asbestos fibers:		4	
Concentration of Chrysotile Asbestos:		0.0107	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0053	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		0.0039	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0234	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0053	Structure/cc
Concentration of Asbestos (total):		**0.0107**	**Structure/cc**

Comments:
None

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ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0074	
Customer Sample #:		HM-BG AA-02	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		1970	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		8	
Analytical Sensitivity:		0.0019	Structure/cc
Number of Primary Asbestos Structures Counted:		1	
Number of total asbestos structures counted:		1	
Number of Asbestos Structures > 5 microns:		1	
Number of Asbestos fibers and bundles > 5 microns:		1	
Number of PCM equivalent asbestos structures:		1	
Number of PCM equivalent asbestos fibers:		1	
Concentration of Chrysotile Asbestos:	<	0.0090	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0057	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0090	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0057	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0090**	**Structure/cc**

Comments:
None

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Attention: Samantha Knight
Engineering/Remediation Resources Group
4585 Pacheco Blvd.
Suite 200
Martinez, CA 94553
Phone: (925) 969-0750
Project: 2011-189

Customer ID: ERRG25
Customer PO:
Received: 9/17/12 11:05 AM

EMSL Order: 091211943
Analysis Date: 10/11/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0075	
Customer Sample #:		HM-BG AA-03	
Date sampled:		9/11/2012	
Initials of Analyst:		KD	
Air volume:		1836	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		9	
Analytical Sensitivity:		0.0018	Structure/cc
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	0.0054	Structure/cc
Concentration of Amphibole Asbestos:	<	0.0054	Structure/cc
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/cc
Upper 95% Confidence Limit (Chrysotile)		0.0054	Structure/cc
Lower 95% Confidence Limit (Amphibole)		NA	Structure/cc
Upper 95% Confidence Limit (Amphibole)		0.0054	Structure/cc
Concentration of Asbestos (total):	**<**	**0.0054**	**Structure/cc**

Comments:
None

Robyn Denton
Approved Signatory

EMSL

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EMSL Order: 091211943
Analysis Date: 10/11/2012
Report Date: 11/19/12

ISO 10312-Ambient Air - Determination of Asbestos Fibers Direct Transfer Transmission Electron Microscopy

EMSL Sample #:		091211943-0076	
Customer Sample #:		HM-FB	
Date sampled:		9/17/2012	
Initials of Analyst:		KD	
Air volume:		0	Liters
Area of collection filter:		385	mm^2
Level of analysis (chrysotile):		CD	
Level of analysis (amphibole):		ADX	
Magnification used for fiber counting:		~19,000	X
Aspect ratio for fiber definition:		3:1	
Minimum length to be counted:	>	5	microns
Minimum width to be coutned:	>	0.25	microns
Mean dimension of grid openings:		0.0129	mm^2
Number of Grid Openings Analyzed:		10	
Analytical Sensitivity:		7.7519	Structure/mm^2
Number of Primary Asbestos Structures Counted:		ND	
Number of total asbestos structures counted:		ND	
Number of Asbestos Structures > 5 microns:		ND	
Number of Asbestos fibers and bundles > 5 microns:		ND	
Number of PCM equivalent asbestos structures:		ND	
Number of PCM equivalent asbestos fibers:		ND	
Concentration of Chrysotile Asbestos:	<	23.1783	Structure/mm^2
Concentration of Amphibole Asbestos:	<	23.1783	Structure/mm^2
Lower 95% Confidence Limit (Chrysotile)		NA	Structure/mm^2
Upper 95% Confidence Limit (Chrysotile)		23.1783	Structure/mm^2
Lower 95% Confidence Limit (Amphibole)		NA	Structure/mm^2
Upper 95% Confidence Limit (Amphibole)		23.1783	Structure/mm^2
Concentration of Asbestos (total):	**<**	**23.1783**	**Structure/mm^2**

Comments:
None

Robyn Denton
Approved Signatory

Test Method	Matrix	EMSL Sample No	Cust Sample No	Result Detection	Date sampled	Analyst	Air Volume	Vol Units	EFA	EFA Units	LoA (chrysotile):	LoA (amphibole):	Magnification
ISO 10312	Air	091211943-0001	HM-MS RS-01	Asbestos Detected, Below Reporting Limit	09/04/12	KD	846	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0002	HM-MS RS-02	None Detected	09/04/12	KD	798	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0003	HM-MS RS-03	None Detected	09/04/12	KD	609	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0004	HM-MS RS-04	None Detected	09/04/12	KD	860	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0005	HM-MS HK-01	Asbestos Detected, Above Reporting Limit	09/05/12	KD	708	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0006	HM-MS HK-02	Asbestos Detected, Below Reporting Limit	09/05/12	KD	705	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0007	HM-MS HK-03	Asbestos Detected, Below Reporting Limit	09/05/12	KD	671	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0008	HM-MS HK-04	Asbestos Detected, Below Reporting Limit	09/05/12	KD	713	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0009	HM-MS ATV-01	Asbestos Detected, Above Reporting Limit	09/05/12	FC	646	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0010	HM-MS ATV-02	Asbestos Detected, Above Reporting Limit	09/05/12	RD	630	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0011	HM-MS ATV-03	Asbestos Detected, Above Reporting Limit	09/05/12	LM	722	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0012	HM-MS ATV-04	Asbestos Detected, Above Reporting Limit	09/05/12	PH	704	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0013	HM-MS ATV-05	Asbestos Detected, Above Reporting Limit	09/05/12	FC	723	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0014	HM-MS MB-01	Asbestos Detected, Above Reporting Limit	09/09/12	KD	544	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0015	HM-MS MB-02	Asbestos Detected, Above Reporting Limit	09/09/12	KD	580	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0016	HM-MS MB-03	Asbestos Detected, Above Reporting Limit	09/09/12	KD	688	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0017	HM-MS MB-04	Asbestos Detected, Above Reporting Limit	09/09/12	KD	675	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0018	HM-MS AA-05	Asbestos Detected, Above Reporting Limit	09/09/12	KD	1717	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0019	HM-MS AA-06	Asbestos Detected, Above Reporting Limit	09/09/12	KD	1694	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0020	HM-AP ATV-01	Asbestos Detected, Above Reporting Limit	09/06/12	FC	595	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0021	HM-AP ATV-02	Asbestos Detected, Above Reporting Limit	09/06/12	FC	660	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0022	HM-AP ATV-03	Asbestos Detected, Above Reporting Limit	09/06/12	PH	568	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0023	HM-AP ATV-04	Asbestos Detected, Above Reporting Limit	09/06/12	PH	662	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0024	HM-AP MB-01	Asbestos Detected, Above Reporting Limit	09/10/12	FC	792	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0025	HM-AP MB-02	Asbestos Detected, Above Reporting Limit	09/10/12	KD	786	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0026	HM-AP MB-03	Asbestos Detected, Above Reporting Limit	09/10/12	KD	730	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0027	HM-AP MB-04	Asbestos Detected, Above Reporting Limit	09/10/12	KD	705	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0028	HM-AP MB-05	Asbestos Detected, Above Reporting Limit	09/10/12	KD	600	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0029	HM-AP HK-01	Asbestos Detected, Above Reporting Limit	09/10/12	KD	710	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0030	HM-AP HK-02	Asbestos Detected, Above Reporting Limit	09/10/12	KD	707	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0031	HM-AP HK-03	Asbestos Detected, Above Reporting Limit	09/10/12	KD	668	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0032	HM-AP HK-04	Asbestos Detected, Above Reporting Limit	09/10/12	KD	685	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0033	HM-AP HK-05	Asbestos Detected, Above Reporting Limit	09/10/12	KD	735	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0034	HM-AP AA-03	Asbestos Detected, Above Reporting Limit	09/10/12	KD	1925	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0035	HM-AP AA-04	Asbestos Detected, Above Reporting Limit	09/10/12	KD	1919	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0036	HM-OP ATV-01	Asbestos Detected, Above Reporting Limit	09/07/12	PH	673	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0037	HM-OP ATV-02	Asbestos Detected, Above Reporting Limit	09/07/12	FC	616	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0038	HM-OP ATV-03	Asbestos Detected, Above Reporting Limit	09/07/12	FC	695	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0039	HM-OP ATV-04	Asbestos Detected, Above Reporting Limit	09/07/12	PH	736	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0040	HM-OP ATV-05	Asbestos Detected, Above Reporting Limit	09/07/12	FC	694	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0041	HM-OP MB-01	Asbestos Detected, Above Reporting Limit	09/07/12	FC	733	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0042	HM-OP MB-02	Asbestos Detected, Above Reporting Limit	09/07/12	KD	696	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0043	HM-OP MB-03	Asbestos Detected, Above Reporting Limit	09/07/12	KD	726	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0044	HM-OP MB-04	Asbestos Detected, Above Reporting Limit	09/07/12	PH	768	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0045	HM-OP HK-01	Asbestos Detected, Above Reporting Limit	09/07/12	KD	726	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0046	HM-OP HK-02	Asbestos Detected, Above Reporting Limit	09/07/12	KD	772	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0047	HM-OP HK-03	Asbestos Detected, Above Reporting Limit	09/07/12	KD	717	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0048	HM-OP HK-04	Asbestos Detected, Above Reporting Limit	09/07/12	KD	726	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0049	HM-OP HK-05	Asbestos Detected, Above Reporting Limit	09/07/12	KD	654	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0050	HM-OP RS-01	Asbestos Detected, Above Reporting Limit	09/11/12	KD	760	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0051	HM-OP RS-02	Asbestos Detected, Above Reporting Limit	09/11/12	KD	737	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0052	HM-OP RS-03	Asbestos Detected, Above Reporting Limit	09/11/12	KD	735	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0053	HM-OP RS-04	Asbestos Detected, Above Reporting Limit	09/11/12	KD	797	L	385	mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0054	HM-OP RS-05	Asbestos Detected, Above Reporting Limit	09/11/12	KD	723	L	385	mm^2	CD	ADX	~19,000

ISO 10312	Air	091211943-0055	HM-OP AA-01	None Detected	09/07/12	KD	1589 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0056	HM-OP AA-02	Asbestos Detected, Below Reporting Limit	09/07/12	KD	1657 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0057	HM-BG ATV-01	Asbestos Detected, Above Reporting Limit	09/09/12	FC	720 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0058	HM-BG ATV-02	Asbestos Detected, Above Reporting Limit	09/09/12	CC	582 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0059	HM-BG ATV-03	Asbestos Detected, Above Reporting Limit	09/09/12	DC	615 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0060	HM-BG ATV-04	Asbestos Detected, Above Reporting Limit	09/09/12	FC	660 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0061	HM-BG MB-01	Asbestos Detected, Below Reporting Limit	09/11/12	KD	765 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0062	HM-BG MB-02	Asbestos Detected, Above Reporting Limit	09/11/12	KD	758 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0063	HM-BG MB-03	Asbestos Detected, Below Reporting Limit	09/11/12	KD	693 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0064	HM-BG MB-04	Asbestos Detected, Above Reporting Limit	09/11/12	KD	684 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0065	HM-BG HK-01	Asbestos Detected, Above Reporting Limit	09/11/12	KD	733 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0066	HM-BG HK-02	Asbestos Detected, Above Reporting Limit	09/11/12	KD	810 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0067	HM-BG HK-03	Asbestos Detected, Above Reporting Limit	09/11/12	KD	724 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0068	HM-BG HK-04	Asbestos Detected, Above Reporting Limit	09/11/12	FC	763 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0069	HM-BG RS-01	Asbestos Detected, Above Reporting Limit	09/12/12	KD	705 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0070	HM-BG RS-02	Asbestos Detected, Above Reporting Limit	09/12/12	KD	705 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0071	HM-BG RS-03	Asbestos Detected, Above Reporting Limit	09/12/12	KD	684 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0072	HM-BG RS-04	Asbestos Detected, Above Reporting Limit	09/12/12	KD	678 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0073	HM-BG AA-01	Asbestos Detected, Above Reporting Limit	09/11/12	KD	1854 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0074	HM-BG AA-02	Asbestos Detected, Below Reporting Limit	09/11/12	KD	1970 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0075	HM-BG AA-03	None Detected	09/11/12	KD	1836 L	385 mm^2	CD	ADX	~19,000
ISO 10312	Air	091211943-0076	HM-FB	None Detected	09/17/12	KD	0 L	385 mm^2	CD	ADX	~19,000

Aspect ratio	Qualifier	Min Fiber Len.	Min Fiber Len Units	Qualifier	Min Fiber Width	Min Fiber Width Units	GO Area	GO Area Units	GOs analyzed	Analytical Sens	Analytical Sens Units	Status	Primary Str	Total Str
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	9	0.0039	Structure/cc	Analyzed	1	1
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	10	0.0037	Structure/cc	Analyzed	0	0
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	13	0.0038	Structure/cc	Analyzed	0	0
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	9	0.0039	Structure/cc	Analyzed	0	0
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0038	Structure/cc	Analyzed	7	7
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0038	Structure/cc	Analyzed	1	1
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	12	0.0037	Structure/cc	Analyzed	2	2
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0038	Structure/cc	Analyzed	1	1
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	12	0.0038	Structure/cc	Analyzed	35	37
3:1	>	5	Micron	>	0.25	Micron	0.0132	mm^2	12	0.0039	Structure/cc	Analyzed	46	48
3:1	>	5	Micron	>	0.25	Micron	0.0132	mm^2	11	0.0037	Structure/cc	Analyzed	39	53
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0039	Structure/cc	Analyzed	47	52
3:1	>	5	Micron	>	0.25	Micron	0.0132	mm^2	11	0.0037	Structure/cc	Analyzed	24	25
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	14	0.0039	Structure/cc	Analyzed	3	3
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	13	0.004	Structure/cc	Analyzed	3	3
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0039	Structure/cc	Analyzed	13	13
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	12	0.0037	Structure/cc	Analyzed	25	25
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	9	0.0019	Structure/cc	Analyzed	14	14
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	9	0.002	Structure/cc	Analyzed	6	6
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	13	0.0039	Structure/cc	Analyzed	9	10
3:1	>	5	Micron	>	0.25	Micron	0.0132	mm^2	12	0.0037	Structure/cc	Analyzed	30	33
3:1	>	5	Micron	>	0.25	Micron	0.0132	mm^2	14	0.0037	Structure/cc	Analyzed	43	49
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	12	0.0038	Structure/cc	Analyzed	11	11
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	10	0.0038	Structure/cc	Analyzed	11	11
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	10	0.0038	Structure/cc	Analyzed	17	17
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0037	Structure/cc	Analyzed	15	15
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0038	Structure/cc	Analyzed	15	15
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	14	0.0036	Structure/cc	Analyzed	19	19
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0038	Structure/cc	Analyzed	21	21
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	12	0.0035	Structure/cc	Analyzed	32	32
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	12	0.0037	Structure/cc	Analyzed	12	12
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	12	0.0036	Structure/cc	Analyzed	26	26
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0037	Structure/cc	Analyzed	11	11
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	8	0.0019	Structure/cc	Analyzed	6	6
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	8	0.0019	Structure/cc	Analyzed	15	15
3:1	>	5	Micron	>	0.25	Micron	0.0132	mm^2	12	0.0036	Structure/cc	Analyzed	13	13
3:1	>	5	Micron	>	0.25	Micron	0.0132	mm^2	9	0.0053	Structure/cc	Analyzed	16	16
3:1	>	5	Micron	>	0.25	Micron	0.0132	mm^2	11	0.0038	Structure/cc	Analyzed	17	20
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0037	Structure/cc	Analyzed	13	13
3:1	>	5	Micron	>	0.25	Micron	0.0132	mm^2	11	0.0038	Structure/cc	Analyzed	17	18
3:1	>	5	Micron	>	0.25	Micron	0.0132	mm^2	11	0.0036	Structure/cc	Analyzed	8	11
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0039	Structure/cc	Analyzed	17	17
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0037	Structure/cc	Analyzed	39	39
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	10	0.0039	Structure/cc	Analyzed	7	8
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0037	Structure/cc	Analyzed	21	21
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	10	0.0039	Structure/cc	Analyzed	22	22
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0038	Structure/cc	Analyzed	7	7
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0037	Structure/cc	Analyzed	5	5
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	12	0.0038	Structure/cc	Analyzed	14	14
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	10	0.0039	Structure/cc	Analyzed	3	3
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0037	Structure/cc	Analyzed	14	14
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0037	Structure/cc	Analyzed	17	17
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	10	0.0037	Structure/cc	Analyzed	18	18
3:1	>	5	Micron	>	0.25	Micron	0.0129	mm^2	11	0.0038	Structure/cc	Analyzed	4	4

3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	10	0.0019	Structure/cc	Analyzed	0	0
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	9	0.002	Structure/cc	Analyzed	2	2
3:1	>	5	Micron	>	0.25	Micron	0.0132 mm^2	11	0.0037	Structure/cc	Analyzed	20	21
3:1	>	5	Micron	>	0.25	Micron	0.0073 mm^2	23	0.0039	Structure/cc	Analyzed	36	39
3:1	>	5	Micron	>	0.25	Micron	0.0073 mm^2	22	0.0039	Structure/cc	Analyzed	35	38
3:1	>	5	Micron	>	0.25	Micron	0.0132 mm^2	12	0.0037	Structure/cc	Analyzed	13	14
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	10	0.0039	Structure/cc	Analyzed	1	1
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	10	0.0039	Structure/cc	Analyzed	23	23
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	11	0.0039	Structure/cc	Analyzed	2	2
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	11	0.004	Structure/cc	Analyzed	16	16
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	11	0.0037	Structure/cc	Analyzed	4	4
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	10	0.0037	Structure/cc	Analyzed	4	4
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	11	0.0037	Structure/cc	Analyzed	22	22
3:1	>	5	Micron	>	0.25	Micron	0.0132 mm^2	11	0.0035	Structure/cc	Analyzed	10	10
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	11	0.0038	Structure/cc	Analyzed	5	5
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	11	0.0038	Structure/cc	Analyzed	7	7
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	11	0.004	Structure/cc	Analyzed	3	3
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	11	0.004	Structure/cc	Analyzed	3	3
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	9	0.0018	Structure/cc	Analyzed	6	6
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	8	0.0019	Structure/cc	Analyzed	1	1
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	9	0.0018	Structure/cc	Analyzed	0	0
3:1	>	5	Micron	>	0.25	Micron	0.0129 mm^2	10	7.7519	Structure/mm^2	Analyzed	0	0

Str > 5 um	Fib & bun > 5um	PCMe str	PCMe fibers	Qualifier	Conc. (Chrys)	Conc. Units	Qualifier	Conc (Amph)	Conc. Units	Qualifier	Lower 95% CL (Chrys)	CL Units	Qualifier	Upper 95% CL (Chrys)
1	1	0	0	<	0.0186	Structure/cc	<	0.0117	Structure/cc		NA	Structure/cc		0.0186
0	0	0	0	<	0.0112	Structure/cc	<	0.0112	Structure/cc		NA	Structure/cc		0.0112
0	0	0	0	<	0.0113	Structure/cc	<	0.0113	Structure/cc		NA	Structure/cc		0.0113
0	0	0	0	<	0.0115	Structure/cc	<	0.0115	Structure/cc		NA	Structure/cc		0.0115
7	7	1	1		0.0268	Structure/cc	<	0.0115	Structure/cc		0.0108	Structure/cc		0.0553
1	1	0	0	<	0.0182	Structure/cc	<	0.0115	Structure/cc		NA	Structure/cc		0.0182
2	2	1	2	<	0.0234	Structure/cc	<	0.0111	Structure/cc		NA	Structure/cc		0.0234
1	1	0	0	<	0.018	Structure/cc	<	0.0114	Structure/cc		NA	Structure/cc		0.018
35	37	8	24		0.0808	Structure/cc		0.0654	Structure/cc		0.05	Structure/cc		0.1236
46	48	24	37		0.1543	Structure/cc		0.0309	Structure/cc		0.1102	Structure/cc		0.2101
39	53	6	44		0.1726	Structure/cc		0.022	Structure/cc		0.1268	Structure/cc		0.2295
48	52	23	52		0.1426	Structure/cc		0.0578	Structure/cc		0.1004	Structure/cc		0.1966
24	24	11	22		0.0477	Structure/cc		0.044	Structure/cc		0.0254	Structure/cc		0.0815
3	3	3	3		0.0304	Structure/cc	<	0.0117	Structure/cc		0.0024	Structure/cc		0.0304
3	3	2	2		0.0307	Structure/cc	<	0.0118	Structure/cc		0.0025	Structure/cc		0.0307
13	13	9	9		0.0513	Structure/cc	<	0.0118	Structure/cc		0.0273	Structure/cc		0.0877
25	25	22	23		0.0884	Structure/cc	<	0.0175	Structure/cc		0.0567	Structure/cc		0.1316
14	14	9	10		0.027	Structure/cc	<	0.0058	Structure/cc		0.0148	Structure/cc		0.0454
6	6	6	6		0.0117	Structure/cc	<	0.0059	Structure/cc		0.0043	Structure/cc		0.0256
9	10	5	10		0.0232	Structure/cc		0.0154	Structure/cc		0.0085	Structure/cc		0.0504
30	33	6	0		0.0994	Structure/cc		0.0221	Structure/cc		0.0655	Structure/cc		0.1447
43	49	31	50		0.1247	Structure/cc		0.055	Structure/cc		0.0864	Structure/cc		0.1743
11	11	7	11		0.0301	Structure/cc		0.015	Structure/cc		0.013	Structure/cc		0.0592
11	11	8	0		0.0188	Structure/cc		0.0226	Structure/cc		0.0061	Structure/cc		0.044
17	17	16	16		0.0646	Structure/cc	<	0.0114	Structure/cc		0.0376	Structure/cc		0.1034
15	15	12	12		0.052	Structure/cc	<	0.0176	Structure/cc		0.0284	Structure/cc		0.0873
15	15	12	12		0.0577	Structure/cc	<	0.0115	Structure/cc		0.0323	Structure/cc		0.0952
19	19	17	19		0.0568	Structure/cc		0.0275	Structure/cc		0.0325	Structure/cc		0.0923
21	21	11	13		0.0802	Structure/cc	<	0.0114	Structure/cc		0.0497	Structure/cc		0.1227
32	32	27	28		0.1091	Structure/cc	<	0.0167	Structure/cc		0.0741	Structure/cc		0.1548
12	12	10	11		0.0447	Structure/cc	<	0.0111	Structure/cc		0.0231	Structure/cc		0.078
26	26	15	20		0.0908	Structure/cc	<	0.0172	Structure/cc		0.0587	Structure/cc		0.134
11	11	8	8		0.0295	Structure/cc		0.0286	Structure/cc		0.0128	Structure/cc		0.0582
6	6	5	5		0.0116	Structure/cc	<	0.0058	Structure/cc		0.0043	Structure/cc		0.0253
15	15	11	12		0.0253	Structure/cc	<	0.0122	Structure/cc		0.0135	Structure/cc		0.0432
13	13	9	12		0.0397	Structure/cc	<	0.0228	Structure/cc		0.0198	Structure/cc		0.0711
16	16	2	9		0.0421	Structure/cc		0.0421	Structure/cc		0.0182	Structure/cc		0.0829
15	20	2	19		0.0649	Structure/cc		0.0296	Structure/cc		0.0378	Structure/cc		0.1038
13	13	7	12		0.0479	Structure/cc	<	0.011	Structure/cc		0.0255	Structure/cc		0.082
17	18	5	10		0.0688	Structure/cc	<	0.0114	Structure/cc		0.0408	Structure/cc		0.1087
8	11	3	8		0.0326	Structure/cc	<	0.0228	Structure/cc		0.0149	Structure/cc		0.0618
17	17	16	16		0.0546	Structure/cc		0.0302	Structure/cc		0.0298	Structure/cc		0.0916
39	39	29	31		0.142	Structure/cc	<	0.0177	Structure/cc		0.1005	Structure/cc		0.1949
7	8	3	8		0.0194	Structure/cc		0.0301	Structure/cc		0.0063	Structure/cc		0.0453
21	21	12	14		0.0673	Structure/cc		0.029	Structure/cc		0.0399	Structure/cc		0.1063
22	22	17	18		0.0812	Structure/cc	<	0.0183	Structure/cc		0.0503	Structure/cc		0.1241
7	7	7	7		0.0189	Structure/cc	<	0.0238	Structure/cc		0.0061	Structure/cc		0.0442
5	5	3	3		0.0187	Structure/cc	<	0.0112	Structure/cc		0.0061	Structure/cc		0.0436
14	14	7	7		0.0418	Structure/cc		0.0295	Structure/cc		0.0209	Structure/cc		0.0749
3	3	2	2		0.0304	Structure/cc	<	0.0117	Structure/cc		0.0024	Structure/cc		0.0304
14	14	12	13		0.0515	Structure/cc	<	0.011	Structure/cc		0.0282	Structure/cc		0.0865
17	17	12	12		0.0554	Structure/cc	<	0.0233	Structure/cc		0.031	Structure/cc		0.0913
18	18	11	14		0.0599	Structure/cc	<	0.0236	Structure/cc		0.0342	Structure/cc		0.0973
4	4	4	4		0.015	Structure/cc	<	0.0112	Structure/cc		0.0041	Structure/cc		0.0384

0	0	0	0	<	0.0056	Structure/cc	<	0.0056	Structure/cc	NA		Structure/cc	0.0056
2	2	1	1	<	0.0126	Structure/cc	<	0.006	Structure/cc	NA		Structure/cc	0.0126
20	21	3	13		0.0626	Structure/cc		0.0147	Structure/cc		0.0365	Structure/cc	0.1002
36	39	13	39		0.13	Structure/cc		0.0236	Structure/cc		0.0895	Structure/cc	0.1826
35	38	17	38		0.1247	Structure/cc		0.0234	Structure/cc		0.0853	Structure/cc	0.1761
13	14	2	12		0.0368	Structure/cc	<	0.0175	Structure/cc		0.0177	Structure/cc	0.0677
1	1	0	0	<	0.0185	Structure/cc	<	0.0117	Structure/cc	NA		Structure/cc	0.0185
23	23	18	18		0.063	Structure/cc		0.0276	Structure/cc		0.036	Structure/cc	0.1023
2	2	1	2	<	0.0247	Structure/cc	<	0.0117	Structure/cc	NA		Structure/cc	0.0247
16	16	8	10		0.0635	Structure/cc	<	0.0119	Structure/cc		0.0363	Structure/cc	0.1031
4	4	4	4	<	0.0233	Structure/cc	<	0.0233	Structure/cc	NA		Structure/cc	0.0233
4	4	4	4		0.0147	Structure/cc	<	0.011	Structure/cc		0.004	Structure/cc	0.0377
22	22	14	17		0.06	Structure/cc		0.0225	Structure/cc		0.0343	Structure/cc	0.0974
10	10	5	8		0.0209	Structure/cc		0.0139	Structure/cc		0.0077	Structure/cc	0.0454
5	5	4	4		0.0192	Structure/cc	<	0.0115	Structure/cc		0.0062	Structure/cc	0.0449
7	7	4	6		0.0231	Structure/cc	<	0.0182	Structure/cc		0.0085	Structure/cc	0.0503
3	3	1	1		0.0307	Structure/cc	<	0.0119	Structure/cc		0.0025	Structure/cc	0.0307
3	3	1	1		0.031	Structure/cc	<	0.012	Structure/cc		0.0025	Structure/cc	0.031
6	6	3	4		0.0107	Structure/cc	<	0.0053	Structure/cc		0.0039	Structure/cc	0.0234
1	1	1	1	<	0.009	Structure/cc	<	0.0057	Structure/cc	NA		Structure/cc	0.009
0	0	0	0	<	0.0054	Structure/cc	<	0.0054	Structure/cc	NA		Structure/cc	0.0054
0	0	0	0	<	23.1783	Structure/mm^2	<	23.1783	Structure/mm^2	NA		Structure/mm^2	23.1783

CL Units	Qualifier	Lower 95% CL (Amph)	CL Units	Qualifier	Upper 95% CL (Amph)	CL Units	Qualifier	Total Asb Con.	Total Asb Conc Units
Structure/cc		NA	Structure/cc		0.0117	Structure/cc	<	0.0186	Structure/cc
Structure/cc		NA	Structure/cc		0.0112	Structure/cc	<	0.0112	Structure/cc
Structure/cc		NA	Structure/cc		0.0113	Structure/cc	<	0.0113	Structure/cc
Structure/cc		NA	Structure/cc		0.0115	Structure/cc	<	0.0115	Structure/cc
Structure/cc		NA	Structure/cc		0.0115	Structure/cc		0.0268	Structure/cc
Structure/cc		NA	Structure/cc		0.0115	Structure/cc	<	0.0182	Structure/cc
Structure/cc		NA	Structure/cc		0.0111	Structure/cc	<	0.0234	Structure/cc
Structure/cc		NA	Structure/cc		0.0114	Structure/cc	<	0.018	Structure/cc
Structure/cc		0.0381	Structure/cc		0.1048	Structure/cc		0.1463	Structure/cc
Structure/cc		0.0133	Structure/cc		0.0608	Structure/cc		0.1852	Structure/cc
Structure/cc		0.0081	Structure/cc		0.048	Structure/cc		0.1946	Structure/cc
Structure/cc		0.0324	Structure/cc		0.0954	Structure/cc		0.2004	Structure/cc
Structure/cc		0.0227	Structure/cc		0.0769	Structure/cc		0.0917	Structure/cc
Structure/cc		NA	Structure/cc		0.0117	Structure/cc		0.0304	Structure/cc
Structure/cc		NA	Structure/cc		0.0118	Structure/cc		0.0307	Structure/cc
Structure/cc		NA	Structure/cc		0.0118	Structure/cc		0.0513	Structure/cc
Structure/cc		NA	Structure/cc		0.0175	Structure/cc		0.0884	Structure/cc
Structure/cc		NA	Structure/cc		0.0058	Structure/cc		0.027	Structure/cc
Structure/cc		NA	Structure/cc		0.0059	Structure/cc		0.0117	Structure/cc
Structure/cc		0.0042	Structure/cc		0.0395	Structure/cc		0.0386	Structure/cc
Structure/cc		0.0081	Structure/cc		0.0481	Structure/cc		0.1215	Structure/cc
Structure/cc		0.0308	Structure/cc		0.0907	Structure/cc		0.1797	Structure/cc
Structure/cc		0.0041	Structure/cc		0.0385	Structure/cc		0.0451	Structure/cc
Structure/cc		0.0083	Structure/cc		0.0492	Structure/cc		0.0415	Structure/cc
Structure/cc		NA	Structure/cc		0.0114	Structure/cc		0.0646	Structure/cc
Structure/cc		NA	Structure/cc		0.0176	Structure/cc		0.052	Structure/cc
Structure/cc		NA	Structure/cc		0.0115	Structure/cc		0.0577	Structure/cc
Structure/cc		0.0022	Structure/cc		0.0275	Structure/cc		0.0844	Structure/cc
Structure/cc		NA	Structure/cc		0.0114	Structure/cc		0.0802	Structure/cc
Structure/cc		NA	Structure/cc		0.0167	Structure/cc		0.1091	Structure/cc
Structure/cc		NA	Structure/cc		0.0111	Structure/cc		0.0447	Structure/cc
Structure/cc		NA	Structure/cc		0.0172	Structure/cc		0.0908	Structure/cc
Structure/cc		0.0023	Structure/cc		0.0286	Structure/cc		0.0581	Structure/cc
Structure/cc		NA	Structure/cc		0.0058	Structure/cc		0.0116	Structure/cc
Structure/cc		NA	Structure/cc		0.0122	Structure/cc		0.0253	Structure/cc
Structure/cc		NA	Structure/cc		0.0228	Structure/cc		0.0397	Structure/cc
Structure/cc		0.0182	Structure/cc		0.0829	Structure/cc		0.0842	Structure/cc
Structure/cc		0.0024	Structure/cc		0.0296	Structure/cc		0.0944	Structure/cc
Structure/cc		NA	Structure/cc		0.011	Structure/cc		0.0479	Structure/cc
Structure/cc		NA	Structure/cc		0.0114	Structure/cc		0.0688	Structure/cc
Structure/cc		NA	Structure/cc		0.0228	Structure/cc		0.0326	Structure/cc
Structure/cc		0.0024	Structure/cc		0.0302	Structure/cc		0.0848	Structure/cc
Structure/cc		NA	Structure/cc		0.0177	Structure/cc		0.142	Structure/cc
Structure/cc		0.0024	Structure/cc		0.0301	Structure/cc		0.0495	Structure/cc
Structure/cc		0.0023	Structure/cc		0.029	Structure/cc		0.0962	Structure/cc
Structure/cc		NA	Structure/cc		0.0183	Structure/cc		0.0812	Structure/cc
Structure/cc		NA	Structure/cc		0.0238	Structure/cc		0.0238	Structure/cc
Structure/cc		NA	Structure/cc		0.0112	Structure/cc		0.0187	Structure/cc
Structure/cc		0.0024	Structure/cc		0.0295	Structure/cc		0.0713	Structure/cc
Structure/cc		NA	Structure/cc		0.0117	Structure/cc		0.0304	Structure/cc
Structure/cc		NA	Structure/cc		0.011	Structure/cc		0.0515	Structure/cc
Structure/cc		NA	Structure/cc		0.0233	Structure/cc		0.0554	Structure/cc
Structure/cc		NA	Structure/cc		0.0236	Structure/cc		0.0599	Structure/cc
Structure/cc		NA	Structure/cc		0.0112	Structure/cc		0.015	Structure/cc

Structure/cc	NA		Structure/cc	0.0056	Structure/cc	<	0.0056	Structure/cc
Structure/cc	NA		Structure/cc	0.006	Structure/cc	<	0.0126	Structure/cc
Structure/cc		0.004	Structure/cc	0.0377	Structure/cc		0.0773	Structure/cc
Structure/cc		0.0087	Structure/cc	0.0515	Structure/cc		0.1537	Structure/cc
Structure/cc		0.0086	Structure/cc	0.0509	Structure/cc		0.1481	Structure/cc
Structure/cc	NA		Structure/cc	0.0175	Structure/cc		0.0368	Structure/cc
Structure/cc	NA		Structure/cc	0.0117	Structure/cc	<	0.0185	Structure/cc
Structure/cc		0.0111	Structure/cc	0.0568	Structure/cc		0.0906	Structure/cc
Structure/cc	NA		Structure/cc	0.0117	Structure/cc	<	0.0247	Structure/cc
Structure/cc	NA		Structure/cc	0.0119	Structure/cc		0.0635	Structure/cc
Structure/cc	NA		Structure/cc	0.0233	Structure/cc		0.0233	Structure/cc
Structure/cc	NA		Structure/cc	0.011	Structure/cc		0.0147	Structure/cc
Structure/cc		0.0083	Structure/cc	0.0489	Structure/cc		0.0824	Structure/cc
Structure/cc		0.0038	Structure/cc	0.0356	Structure/cc		0.0348	Structure/cc
Structure/cc	NA		Structure/cc	0.0115	Structure/cc		0.0192	Structure/cc
Structure/cc	NA		Structure/cc	0.0182	Structure/cc		0.0231	Structure/cc
Structure/cc	NA		Structure/cc	0.0119	Structure/cc		0.0307	Structure/cc
Structure/cc	NA		Structure/cc	0.012	Structure/cc		0.031	Structure/cc
Structure/cc	NA		Structure/cc	0.0053	Structure/cc		0.0107	Structure/cc
Structure/cc	NA		Structure/cc	0.0057	Structure/cc	<	0.009	Structure/cc
Structure/cc	NA		Structure/cc	0.0054	Structure/cc	<	0.0054	Structure/cc
Structure/mm^2	NA		Structure/mm^2	23.1783	Structure/mm^2	<	23.1783	Structure/mm^2

3. Worksheets/Benchsheets

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0001**	Volume (L):	846	Scope:	09-02
Customer Sample:	HM-MS-RS-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	A, 1-2	Analysis Date:	9/18/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		***Comments:***
GO Required:	9		none	3:1 5:1	
GO Analyzed:	9				
Level of Analysis Chrysotile:	CD		Min Length:	>. 5 micron	
Level of Analysis Amphibole:	ADX		Min Width:	0.25 micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A1	F1	None Detected									
A1	F3	None Detected									
A1	F5	None Detected									
A1	F7	None Detected									
A1	F9	B	1	1	38	3.1	CDQ	CHRYS		43885	YES
A2	F3	None Detected									
A2	F5	None Detected									
A2	F7	None Detected									
A2	F9	None Detected									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 091211943-0001 **Client:**

Client Sample:

Page 1 of 1

Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Structure #	Structure #	Structure #	Structure #

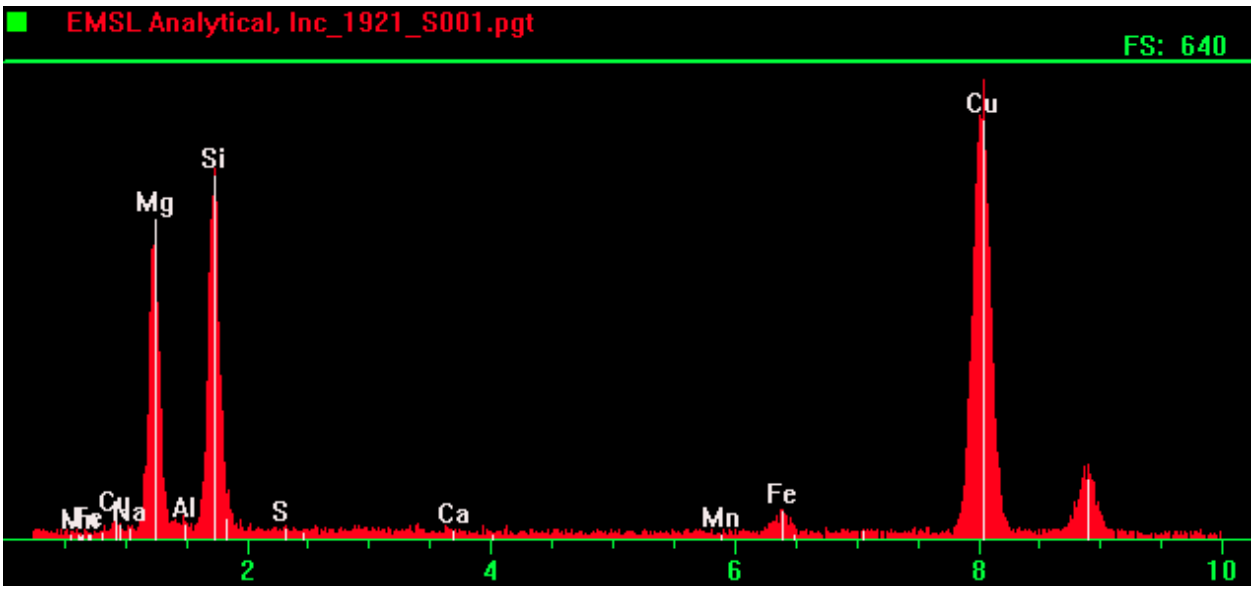
Analyst: KD Date: 18 Sept 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0001_TEM_ISO_10312_EDX_Chrysotile
Collected: September 18, 2012 19:06:10

Live Time:	32.35	Count Rate:	1932	Dead Time:	21.92 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	8.5	8.9	0.0	0.0
Mg	KA1	221.9	11.1	210.8	19.0
Al	KA1	16.4	11.1	5.3	0.5
Si	KA1	287.2	12.2	275.0	22.5
S	KA1	10.2	10.0	0.2	0.0
Ca	KA1	8.8	8.0	0.8	0.1
Mn	KA1	9.0	8.6	0.4	0.1
Fe	KA1	32.4	8.9	23.4	2.6
Cu	KA1	538.5	9.6	528.8	54.8

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/02/12

Indexing of negative number: 43885 SCOPE #: 2

Reference / Sample Number: 1

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.47 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.00	mm

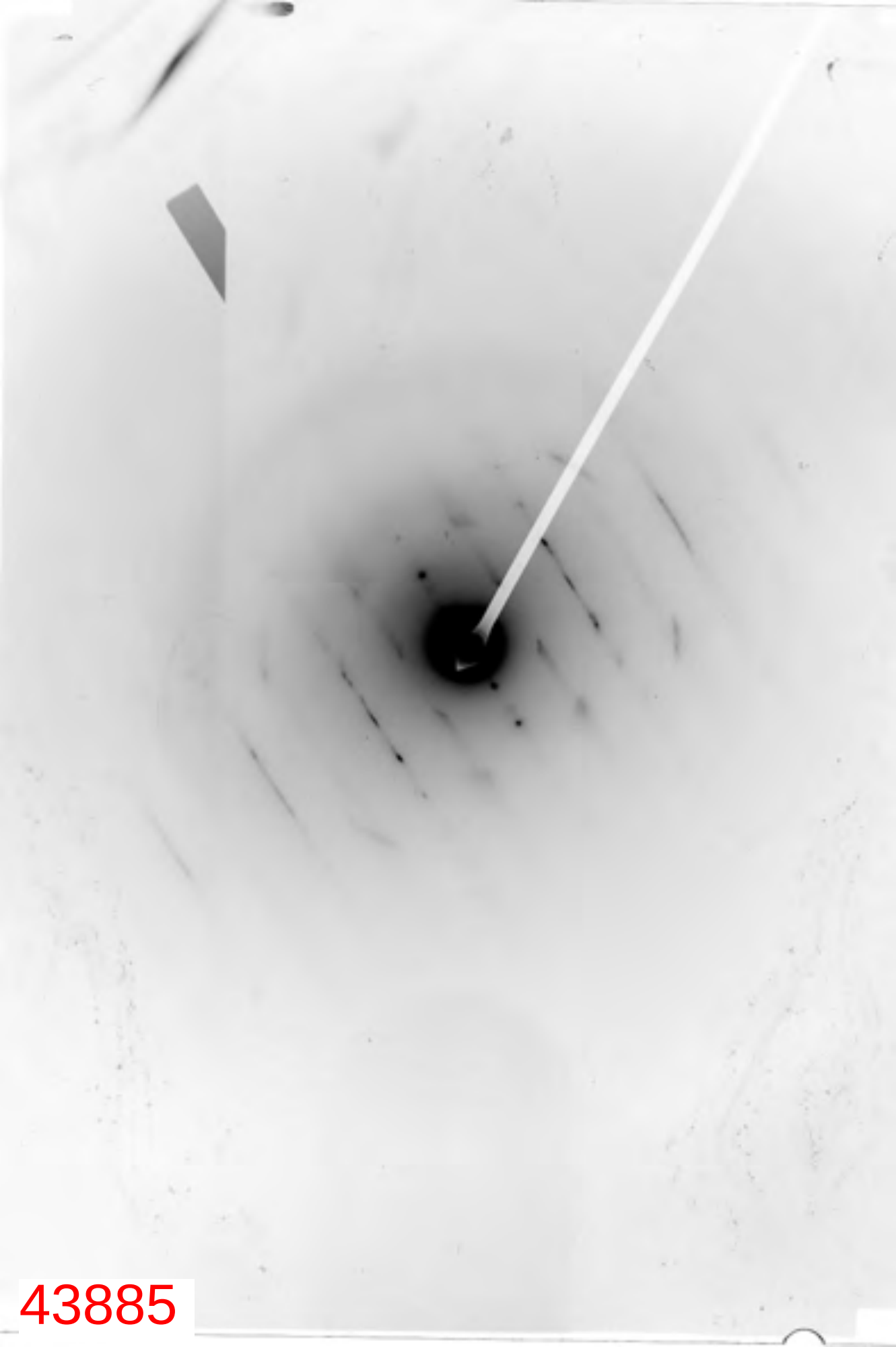
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.35**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.79**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43885

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0002**	Volume (L):	798	Scope:	09-02
Customer Sample:	HM-MS-RS-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	A 3-4	Analysis Date:	9/18/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	10	none	3:1	5:1	
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A3	D10	None Detected									
A3	D8	None Detected									
A3	D6	None Detected									
A3	D4	None Detected									
A3	D2	None Detected									
A4	E1	None Detected									
A4	E3	None Detected									
A4	E5	None Detected									
A4	E7	None Detected									
A4	E9	None Detected									

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0003	Volume (L):	609	Scope:	09-02
Customer Sample:	HM-MS-RS-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	A 5-6	Analysis Date:	9/18/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	13	none	3:1	5:1	
GO Analyzed:	13				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/20/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A5	D1	None Detected									
A5	D3	None Detected									
A5	D5	None Detected									
A5	D7	None Detected									
A5	D9	None Detected									
A5	E10	None Detected									
A5	E8	None Detected									
A6	J10	None Detected									
A6	J8	None Detected									
A6	J6	None Detected									
A6	J3	None Detected									
A6	J1~~0~~ 11/20/12 DM	None Detected									
A6	D5	None Detected									

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0004**	Volume (L):	860	Scope:	09-02
Customer Sample:	HM-MS-RS-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	B, 1-2	Analysis Date:	9/19/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	9	none	3:1	5:1	
GO Analyzed:	9				
Level of Analysis Chrysotile:	CD~~Q~~ 11/26/12 DJM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B1	E1	None Detected									
B1	E3	None Detected									
B1	E5	None Detected									
B1	E7	None Detected									
B2	E9	None Detected									
B2	F7	None Detected									
B2	F5	None Detected									
B2	F3	None Detected									
B2	F1	None Detected									

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0005**	Volume (L):	708	Scope:	09-02
Customer Sample:	HM-MS-HK-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	B, 3-4	Analysis Date:	9/19/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CDQ / Ilhalr		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B3	E1	None Detected									
B3	E3	B	1	1	31.3	10.5	CD	CHRYS		43888	
B3	E5	None Detected									
B3	E7	B	2	2	80.6	6.5	CDQ	CHRYS			YES
B3	E7	B	3	3	13.3	3.1	CD	CHRYS			
B3	E9	B	4	4	11.2	5.5	CD	CHRYS			
B3	F10	None Detected									
B4	H1	B	5	5	20.1	3	CD	CHRYS			
B4	H3	B	6	6	11.1	3.5	CD	CHRYS			
B4	H5	None Detected									
B4	H7	B	7	7	38.8	4.55	CD	CHRYS			
B4	H9	None Detected									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

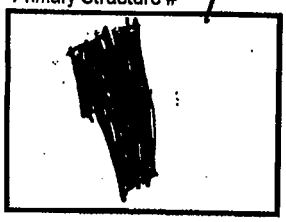
Structure Sketch Sheet

EMSL Order ID: 091211943-0005 **Client:**

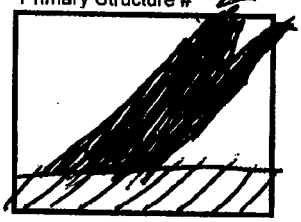
Client Sample:

Page 1 of 1

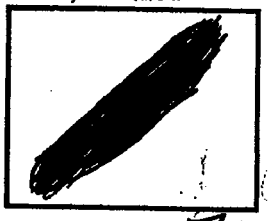
Primary Structure # 1



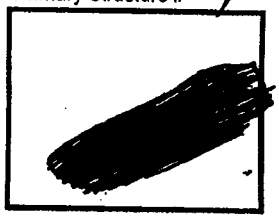
Primary Structure # 2



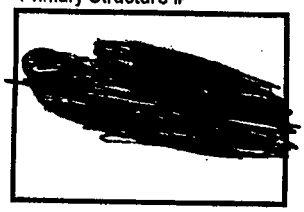
Primary Structure # 3



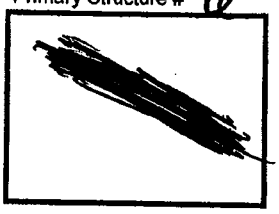
Primary Structure # 4



Primary Structure # 5



Primary Structure # 6



Primary Structure # 7

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

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Primary Structure #

Primary Structure #

Structure #

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Structure #

Structure #

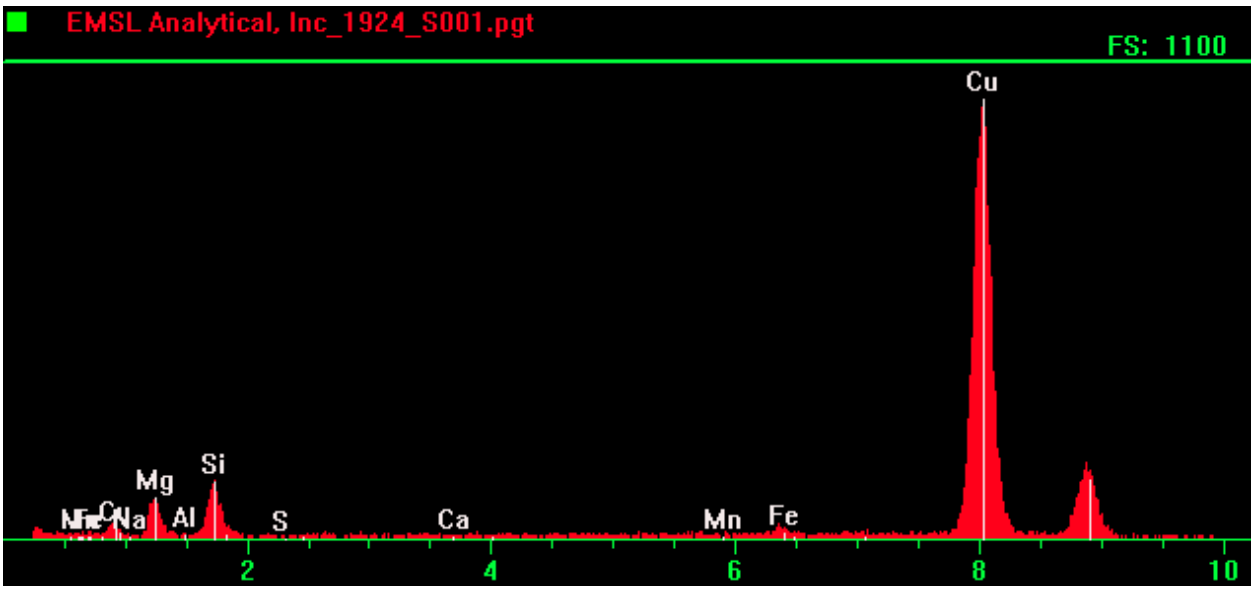
Analyst: KD Date: 19 SEPT 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0005_TEM_ISO_10312_EDX_Chrysotile
Collected: September 19, 2012 13:18:39

Live Time:	29.75	Count Rate:	2151	Dead Time:	27.07 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	7.0	7.0	0.0	0.0
Mg	KA1	60.0	7.3	52.7	7.3
Al	KA1	8.2	7.3	0.9	0.1
Si	KA1	86.1	7.6	78.5	10.3
S	KA1	6.0	6.4	0.0	0.0
Ca	KA1	7.7	6.1	1.6	0.3
Mn	KA1	10.4	9.7	0.7	0.1
Fe	KA1	25.1	9.9	15.2	1.5
Cu	KA1	1005.5	12.1	993.4	82.1

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/02/12

Indexing of negative number: 43888 SCOPE #: 2

Reference / Sample Number: 0005

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.00	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.79**	**4.58**	**4.351**	**4.809**

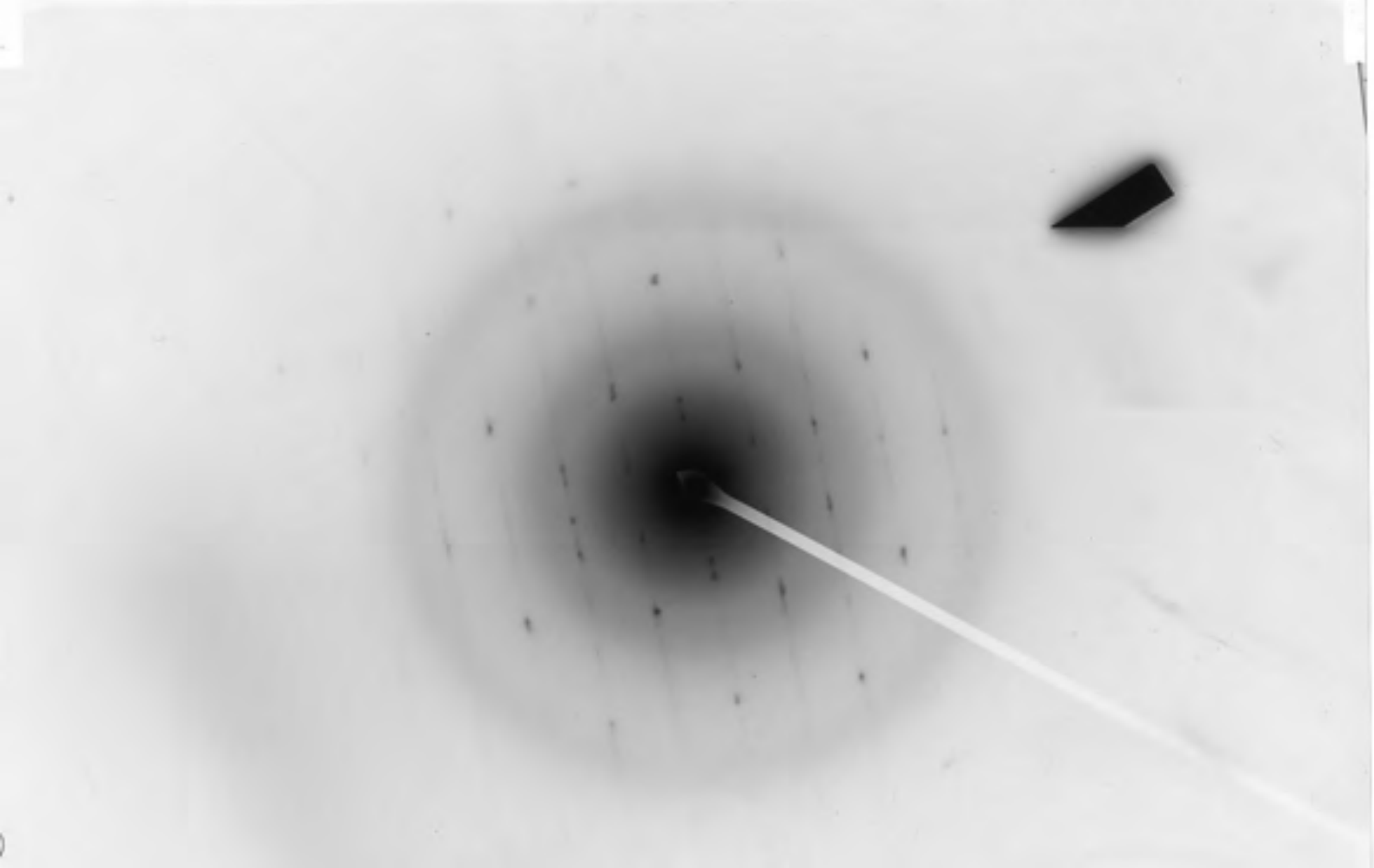
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9943888



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0006**	Volume (L):	705	Scope:	09-02
Customer Sample:	HM-MS-HK-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	B, 5-6	Analysis Date:	9/19/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CDQ 11/24/12 DM	Min Length:	> 5	5	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	0.25	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B5	E10	ND									
B5	E8	ND									
B5	E6	ND									
B5	E4	ND									
B5	E2	ND									
B5	D1	ND									
B6	D1	ND									
B6	D3	ND									
B6	D5	ND									
B6	D7	B	1	1	25.8	6.05	CDQ	CHRYS		43889	YES
B6	E9	ND									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 0912111943-0006 **Client:**

Client Sample: _____ Page 1 of 1

Primary Structure # 1	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Structure #	Structure #	Structure #	Structure #

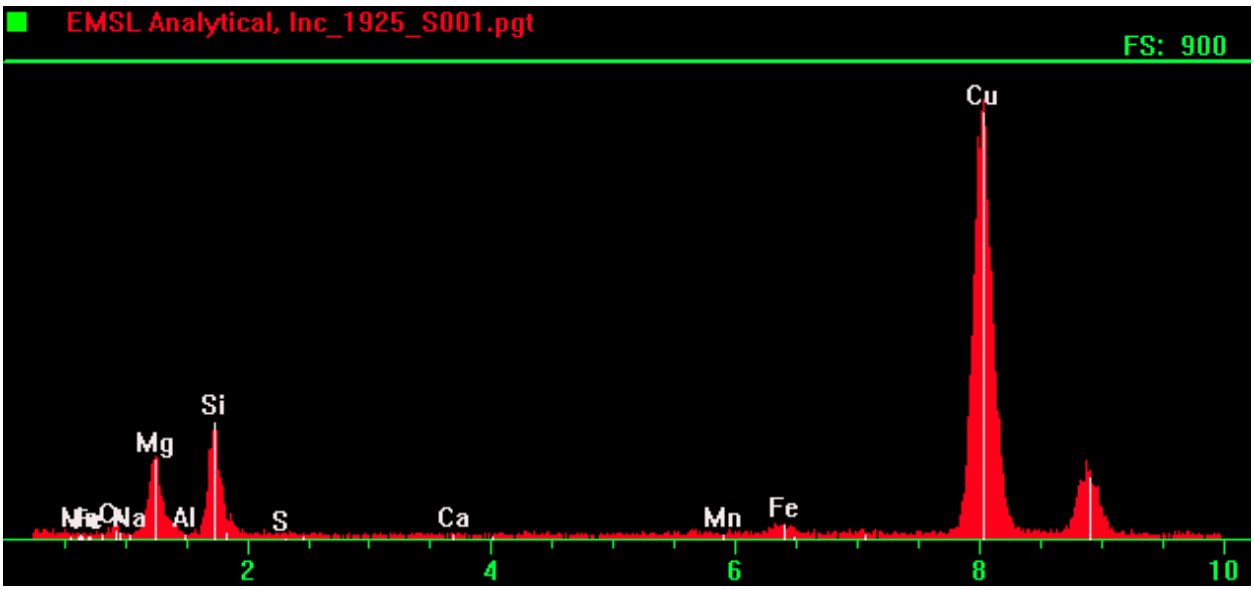
Analyst: KD Date: 19SEPT12 Scope: E

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0006_TEM_ISO_10312_EDX_Chrysotile
Collected: September 19, 2012 16:16:34

Live Time:	17.50	Count Rate:	3551	Dead Time:	40.78 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	12.7	14.6	0.0	0.0
Mg	KA1	175.7	15.2	160.5	10.6
Al	KA1	17.1	16.2	0.9	0.1
Si	KA1	231.0	15.4	215.6	14.0
S	KA1	13.2	11.2	2.0	0.2
Ca	KA1	11.9	10.5	1.4	0.1
Mn	KA1	17.5	18.4	0.0	0.0
Fe	KA1	46.8	18.5	28.3	1.5
Cu	KA1	1416.1	27.4	1388.7	50.6

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/02/12

Indexing of negative number: 43889 SCOPE #: 2

Reference / Sample Number: 0006

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.55 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.33	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

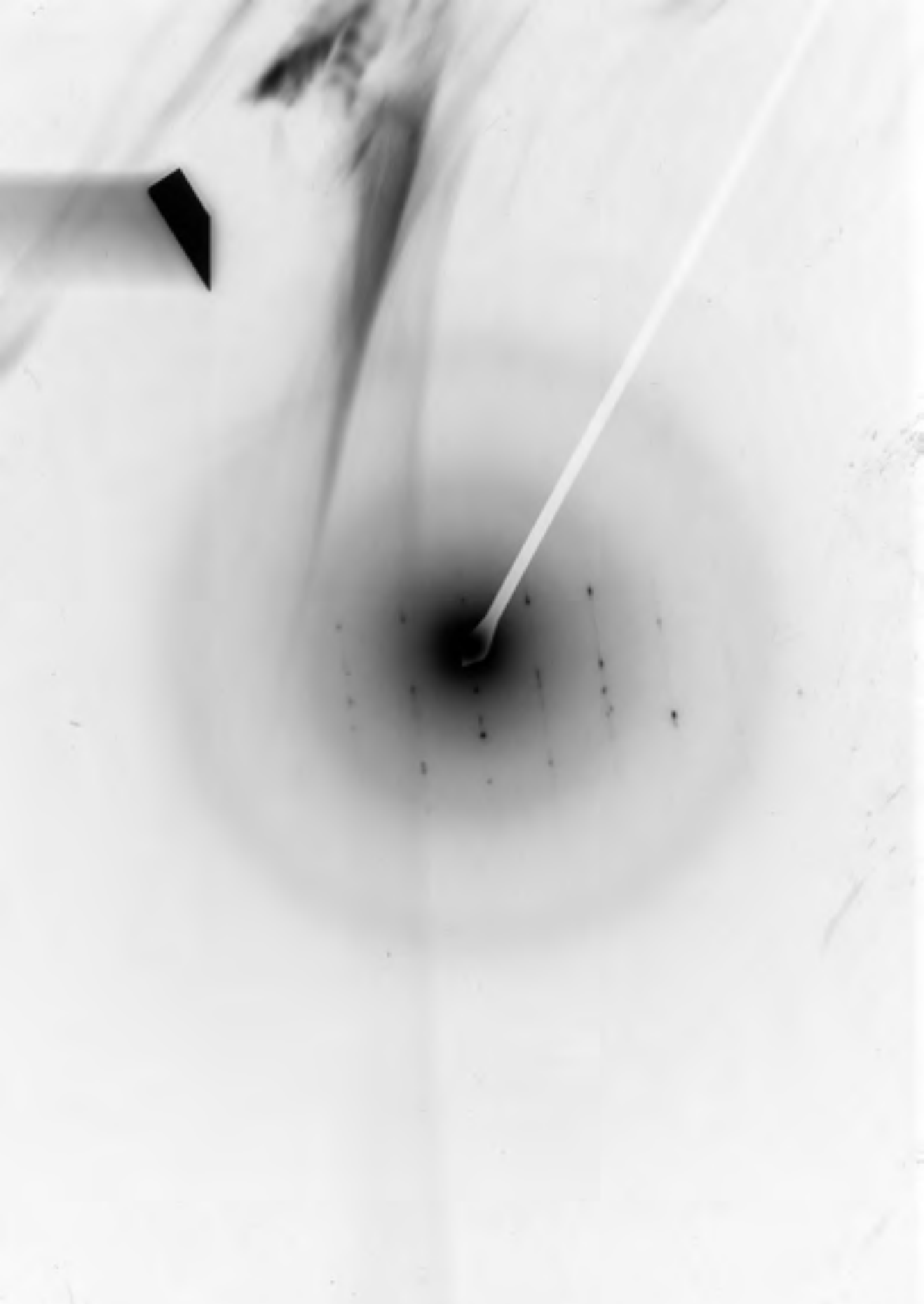
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.26**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.19**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43889

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0007**	Volume (L):	671	Scope:	09-02
Customer Sample:	HM-MS-HK-03 11/20/12 DM	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	C, 1-2	Analysis Date:	9/19/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	12	none	3:1	5:1	
GO Analyzed:	12				
Level of Analysis Chrysotile:	CDQ 11/20/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
C1	D1	None Detected									
C1	D3	None Detected									
C1	D5	B	1	1	10.1	2.8	CDQ	CHRYS		43890	YES
C1	D7	None Detected									
C1	D9	None Detected									
C1	E10	None Detected									
C2	E1	None Detected									
C2	E3	None Detected									
C2	E5	None Detected									
C2	E7	None Detected									
C2	E9	None Detected									
C2	F10	MD11	2		14.6	5	CD	CHRYS			
C2	F10	MB		2	14.6	2	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 0912 11943-0007

Client:

Client Sample:

Page 1 of 1

Primary Structure # 1	Primary Structure # 2	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Structure #	Structure #	Structure #	Structure #

Analyst: KD

Date: 19 Sept 12

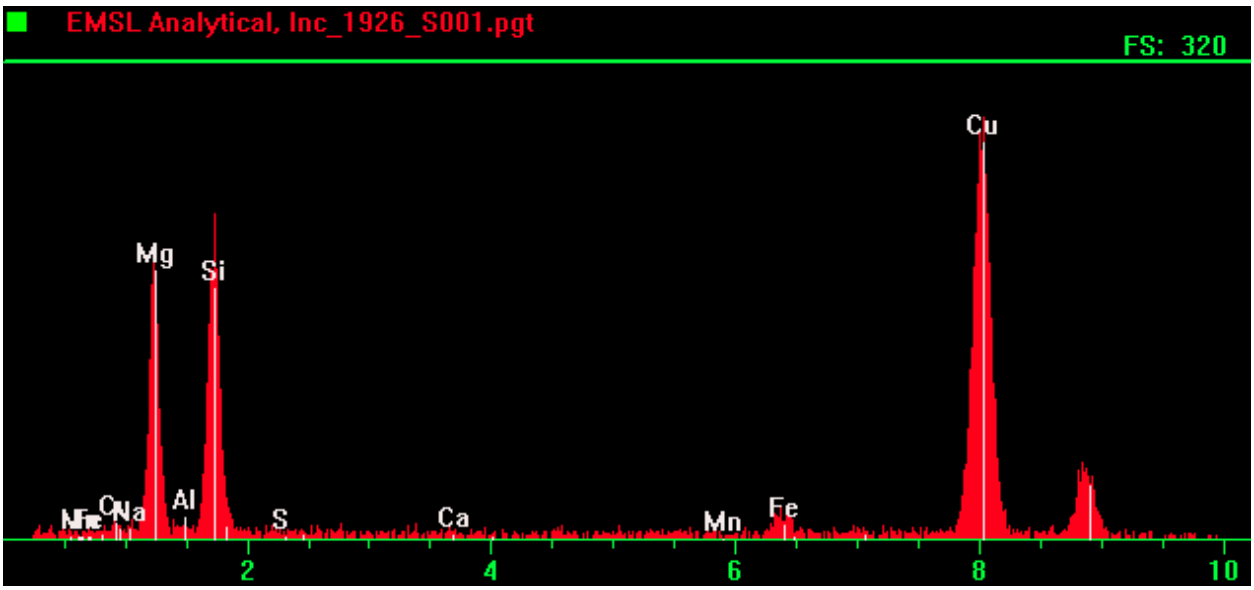
Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0007_TEM_ISO_10312_EDX_Chrysotile
Collected: September 19, 2012 18:29:34

Live Time:	32.75	Count Rate:	819	Dead Time:	10.00 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.7	3.5	0.0	0.0
Mg	KA1	94.0	4.0	90.0	22.7
Al	KA1	6.6	4.4	2.2	0.5
Si	KA1	120.0	4.5	115.6	25.7
S	KA1	3.7	3.3	0.4	0.1
Ca	KA1	3.3	1.8	1.5	0.8
Mn	KA1	3.6	3.3	0.3	0.1
Fe	KA1	13.9	3.3	10.6	3.2
Cu	KA1	246.6	3.7	242.9	66.3

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/02/12

Indexing of negative number: 43890 SCOPE #: 2

Reference / Sample Number: 0007

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.6 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.28	mm
Measured distance, center spot to closest hk1 spot (110):	5.10	mm

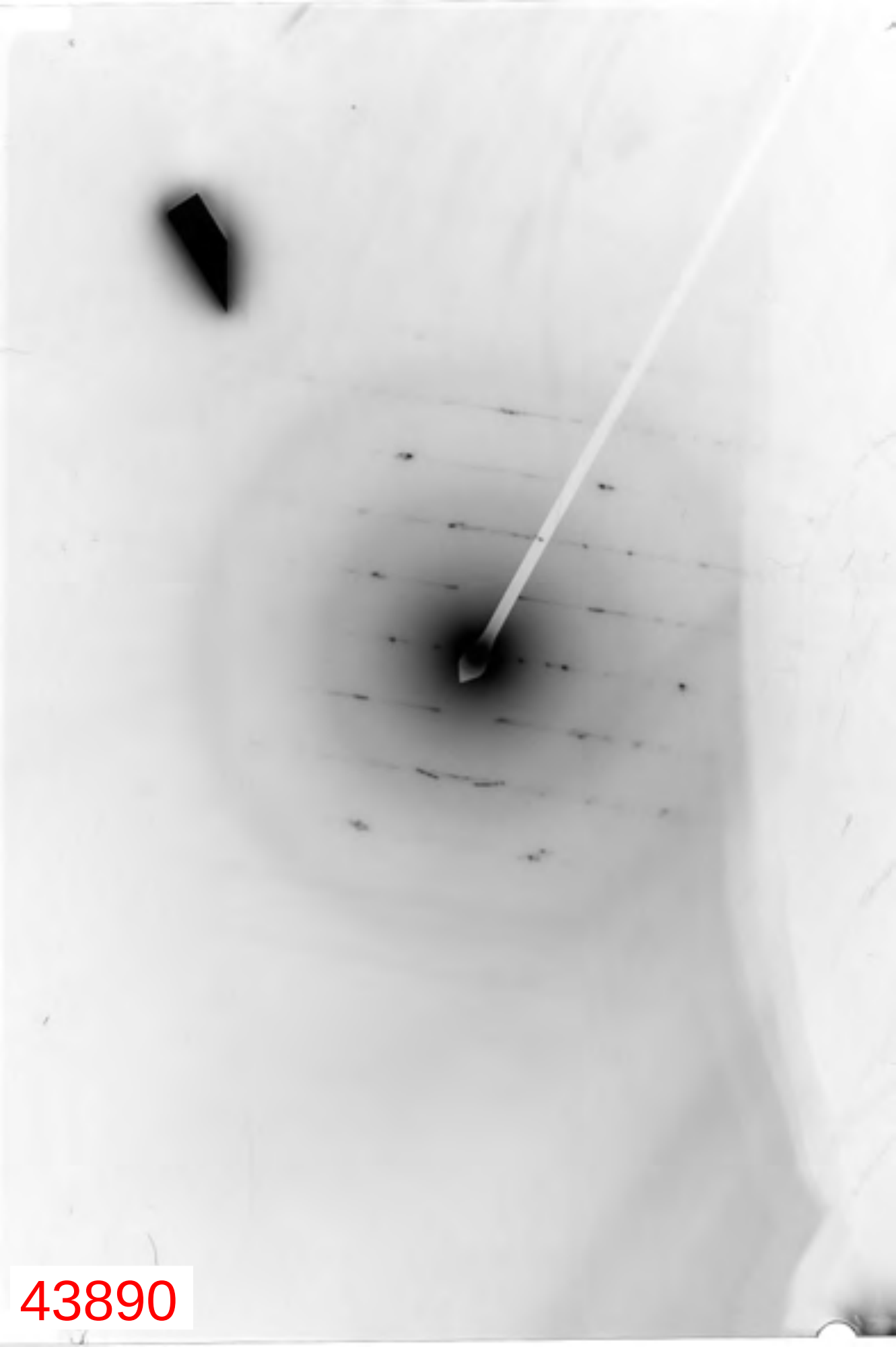
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.20**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.31**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.69**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43890

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0008**	Volume (L):	713	Scope:	09-02
Customer Sample:	HM-MS-HK-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	Air	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	121001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	C, 3-4	Analysis Date:	9/19/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CDQ 11/26/12	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
C3	G9	ND									
C3	G7	ND									
C3	G5	B	1	1	40.1	9.6	CDQ	CHRYS		43891	YES
C3	G3	ND									
C3	G1	ND									
C3	D1	ND									
C4	H1	ND									
C4	H3	ND									
C4	H5	ND									
C4	H7	ND									
C4	H9	ND									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

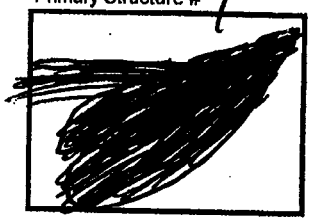
Structure Sketch Sheet

EMSL Order ID: 091211943-0008 **Client:**

Client Sample:

Page 1 of 1

Primary Structure # 1



Primary Structure #

Primary Structure #

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Primary Structure #

Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

Analyst: KD

Date: 19SEPT12

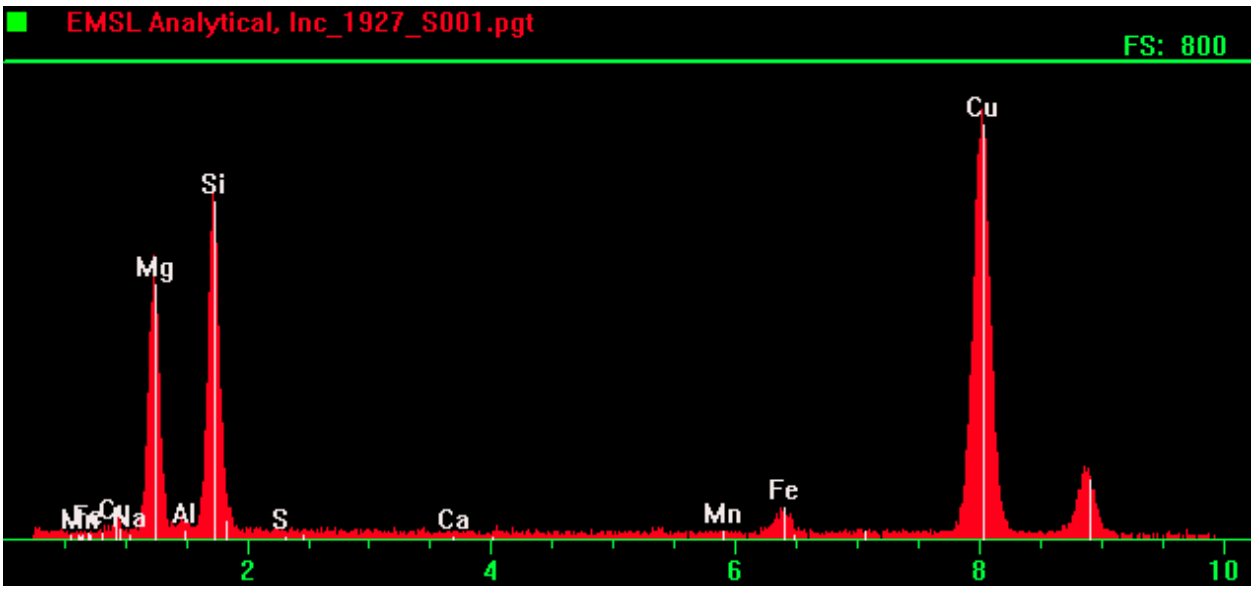
Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0008_TEM_ISO_10312_EDX_Chrysotile
Collected: September 19, 2012 18:34:47

Live Time:	64.06	Count Rate:	1114	Dead Time:	13.12 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	5.0	5.8	0.0	0.0
Mg	KA1	130.3	7.1	123.2	17.3
Al	KA1	9.5	7.5	2.0	0.3
Si	KA1	165.9	7.2	158.7	22.0
S	KA1	4.9	5.6	0.0	0.0
Ca	KA1	4.5	3.7	0.8	0.2
Mn	KA1	5.0	4.5	0.5	0.1
Fe	KA1	21.0	4.5	16.5	3.7
Cu	KA1	321.7	6.2	315.5	50.5

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 11/26/12

Indexing of negative number: 43891 SCOPE #: 2

Reference / Sample Number: 008

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.55 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	5.26	5.30	5.035	5.565
Angle to 110 reflection (Measured °)	60	60	57.000	63.000
d2 or d hk 0 (002) (Angstroms)	7.25	7.32	6.954	7.686
d1 or d hk 1 (110) (Angstroms)	4.74	4.58	4.351	4.809

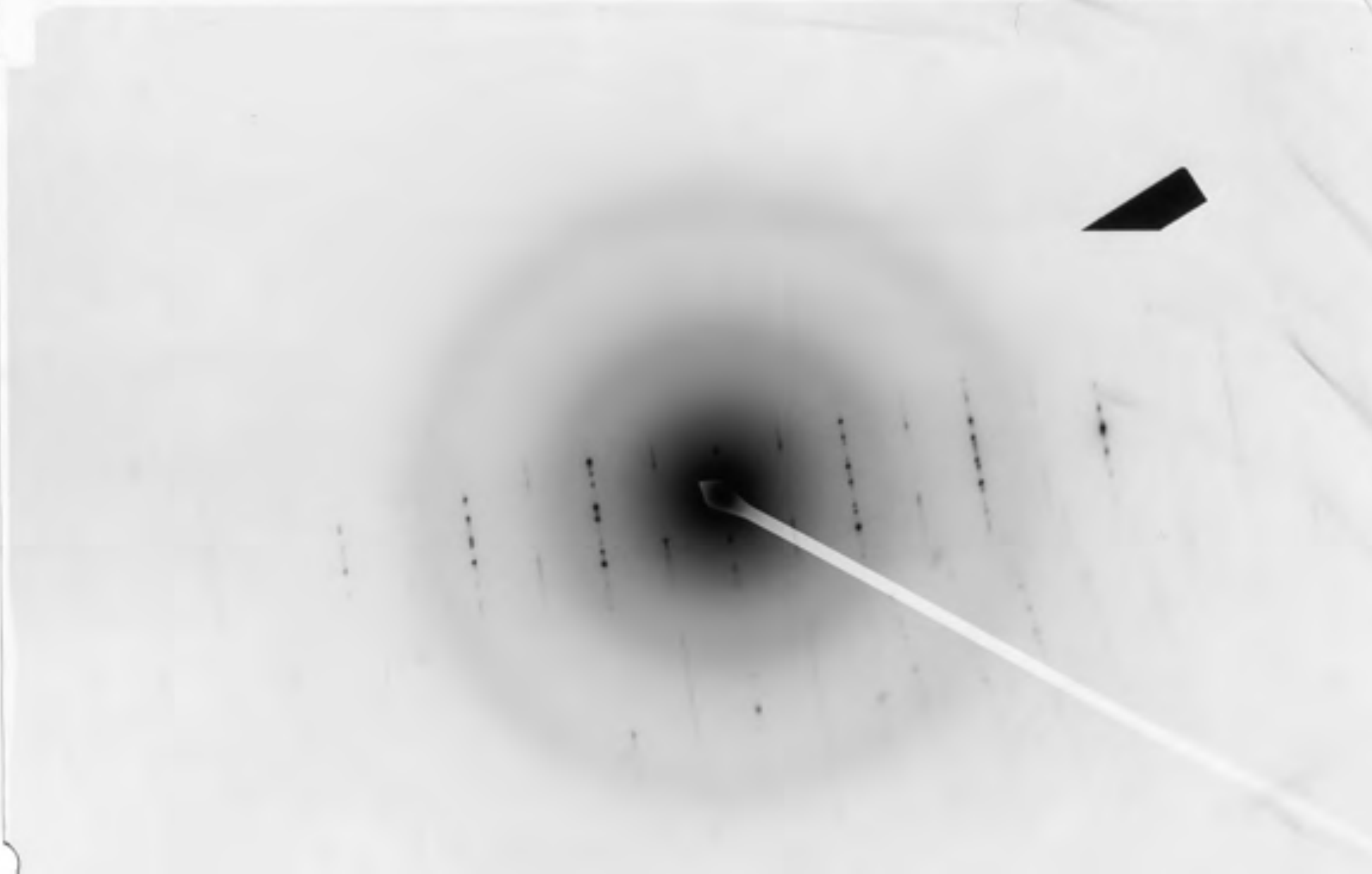
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9843891



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0009	Volume (L):	646	Scope:	09-02
Customer Sample:	HM-MS-AT~~C~~-01 11/20/12 DM	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	E, 1-3	Analysis Date:	9/20/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	12	none	3:1	5:1	
GO Analyzed:	0				OVERLOADED
Level of Analysis Chrysotile:	CD~~Ø~~ 11/20/12 DM	Min Length:	> 5	micron	30%
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
~~E1~~	11/20/12 DM										

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0009**	Volume (L):	646	Scope:	04-01
Customer Sample:	HM-MS-AT~~C~~V-01 11/28/12 DM	Prepped By:	PK	GO area (mm2):	~~.0132~~ 0.0129 RD 11-15-12
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F. CRAIG
EFA (mm^2):	385	Grid Location:	E, 1-3	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)	none	3:1	5:1
GO Required:	12				
GO Analyzed:	12 11/28/12 DM				
Level of Analysis Chrysotile:	CD~~O~~	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	≥0.25	micron	

Comments:

30% PART. LOADING
VERTICAL TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E1	C9	MD11	1		14	6.5					
		MB		1	8	.5	CD	CH		011337	1
		F	2	2	6.3	.25	ADX	ACT		011338	1
		MD11	3		14.2	12.5					
		MB		3	28.4	6	CD	CH			
		MC~~H~~ 22	4	4	29	27	ADX	ACT			
	B7	MD11	5		7.2	3.6					
		MB		5	7.2	1	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0009 11/28/12 DM	Volume (L):	646	Scope:	04-01
Customer Sample:	HM-MS-ATC-01	Prepped By:	PK	GO area (mm2):	~~.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	E, 1-3	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E1	B7	MD11	6		15	6.5					
		MB		6	8	.75	CD	CH			
		MD11	7		67	10.5					
		MB		7	67	2.5	CD	CH			
		MC11	8	8	60	55	ADX	ACT		---	
		MD11	9		11	4.5					
		MB		9	7	.5	CD	CH			
	D7	B	10	10	5.25	1	CD	CH			
		MD11	11		8.5	1.5					
		MB		11	8.5	1	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0009**	Volume (L):	646	Scope:	04-01
Customer Sample:	HM-MS-AT~~2~~-01 11/28/12 DM	Prepped By:	PK	GO area (mm2):	~~.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	FCRAIG
EFA (mm^2):	385	Grid Location:	E, 1-3	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E1	F7	MD11	12		7.8	6					
		MB		12	7.8	.5	CD	CH			
		F	0	0	7.6	.8	ADX	TREM		011340	1
		MD11	13		19	17					
		MB	~~13~~ 11/28/12	13	12.8	1.5	CD	CH			
		F	14	14	6	1.4	ADX	ACT			
		MD11	15		13.5	11					
		MF		15	13.5	.6	ADX	ACT			
		MD11	16		13	9.5					
		MF		16	8.5	1.5	ADX	ACT			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0009	Volume (L):	646	Scope:	04-01
Customer Sample:	HM-MS-AT~~C~~-01 11/28/12 DJM	Prepped By:	PK	GO area (mm2):	~~.0132~~ .0129 11/28/12 DJM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	FCRAIG
EFA (mm^2):	385	Grid Location:	E, 1-3	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DJM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
E1	F7	MC41	17	17	18	7	CD	CH			
		MC21	18	18	30	23	CD	CH			
		MC22	19	19	42	19	CD	CH			
	I9	MD53	20		75	64				011342	
		MF		0	14	.3	NAM	NAM			
		MR11		0	15	1.5	NAM	NAM	SEE PHOTO		
		MR11		20	11.5	1.2	ADX	ACT			
		MR10		21	5	.7	ADX	ACT			
		MR10		0	4.8	.25	NAM	NAM			
		MC11	21	22	27	24	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0009	Volume (L):	646	Scope:	04-01
Customer Sample:	HM-MS-ATC-01 11/28/12 DM	Prepped By:	PK	GO area (mm2):	~~.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	E, 1-3	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CDQ 11/28/12 DM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E2	B5	MC11	0	0	18	16	ADX	ACT			
		MD11	22		13	9.6					
		MB		23	6	.3	CD	CH			
		MC21	0	0	23.5	13	CD/ADX	CH/ACT			
		MD21	23						24		
		MB		24	17.9	2.2	CD	CH	0		
		MR10		0	4.5	.3	NAM	NAM			
		MD11	24		68	35					
		MF		25	13.6	.75	ADX	ACT			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0009	Volume (L):	646	Scope:	04-01
Customer Sample:	HM-MS-AT~~C~~-01 11/28/12 DJM	Prepped By:	PK	GO area (mm2):	.0129 ~~.0138~~ 11/28/12 DJM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	E, 1-3	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DJM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E2	D6	MC22	0	6	20	15	CD/ADX	CH/ACT			
		F	25	26	5.8	1	ADX	TREM			
		MC41	26	27	59	25	CD/ADX	CH/TREM			
E3	A6	MC11	27	28	14.5	13.5	ADX	ACT			
		MC52	28	29	46	33	CD/NAM	CH/NAM			
	C8	B	29	30	7.2	.7	CD	CH			
		MC31	0 ~~30~~	0 ~~31~~ 11/28/12 DJM	11.2	10.8	ADX	NRA			
	E10	MD22	0		19.5	18.5					
		MF		0	16	3	NAM	NAM	NAM		
		MR11		0	13.8	1	ADX	NRA			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0009	Volume (L):	646	Scope:	04-01
Customer Sample:	HM-MS-AT~~C~~Y-01 11/28/12 DM	Prepped By:	PK	GO area (mm2):	~~.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	E, 1-3	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E3	E10	MD22	0		11	7					
		MF		0	11	1.7	ADX	NRA	NRA		
		MF		0			NAM	NAM			
		MC33	30 ~~31~~	31 ~~32~~	47	34	ADX/NAM	TREM/NAM	TREM		
		MD22	31 ~~32~~		14	11					
		MF		32 ~~33~~	5.7	.5	ADX	ACT			
		MR11		33 ~~34~~	9	.75	ADX	ACT	33 34		
		MD11	32 ~~33~~		20.5	13					
		MB		34 ~~35~~	19	.6	CP	CH			
	G9	F	33 ~~34~~	35 ~~36~~	8	.8	ADX	ACT			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0009	Volume (L):	646	Scope:	04-01
Customer Sample:	HM-MS-AT~~C~~-01 11/28/12 DM	Prepped By:	PK	GO area (mm2):	~~.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	E, 1-3	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~O~~ 11/28/12 DM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

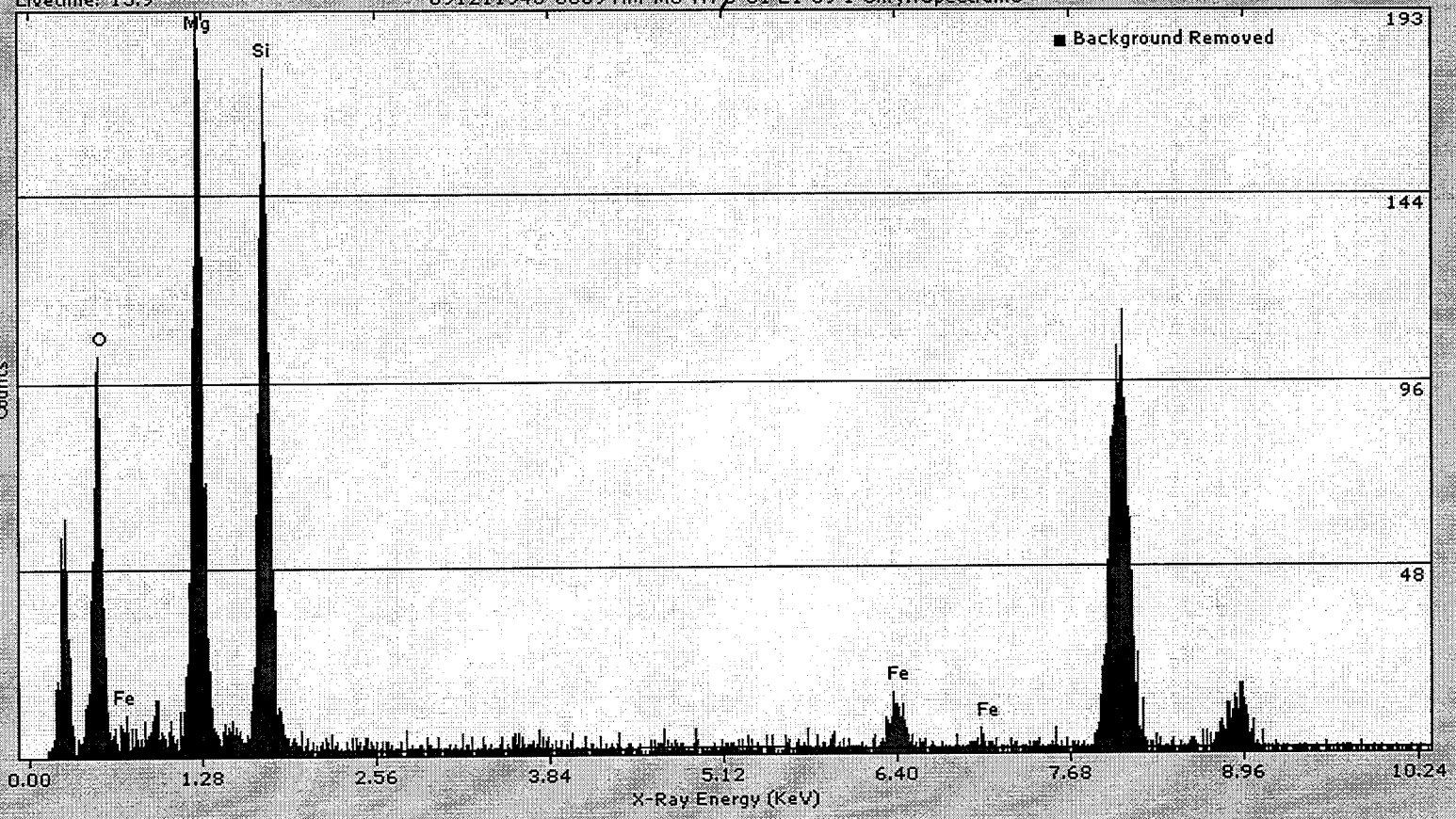
Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E3	G9	MC11	34 ~~35~~	36 ~~37~~ 11/28/12 DM	44	32	ADX	TREM			
		MD33	0		28	24					
		MF		0			NAM	NAM			
		MF		0	5.5	.75	ADX	NRA			
		MR11		0	11	.5	ADX	NRA	NAM		
	I6	MD11	35 ~~36~~	11/28/12 DM	7.5	3					
		MB		37 ~~38~~	6	.6	CD	CH			
		MD11	0		17	10					
		MF		0	8	1	ADX	NRA			

11/28/12 DM

Realtime: 19.4
Livetime: 15.9

091211943-0009 HM-MS-ATZ-01 E1 C9 1 Chry::Spectrum3

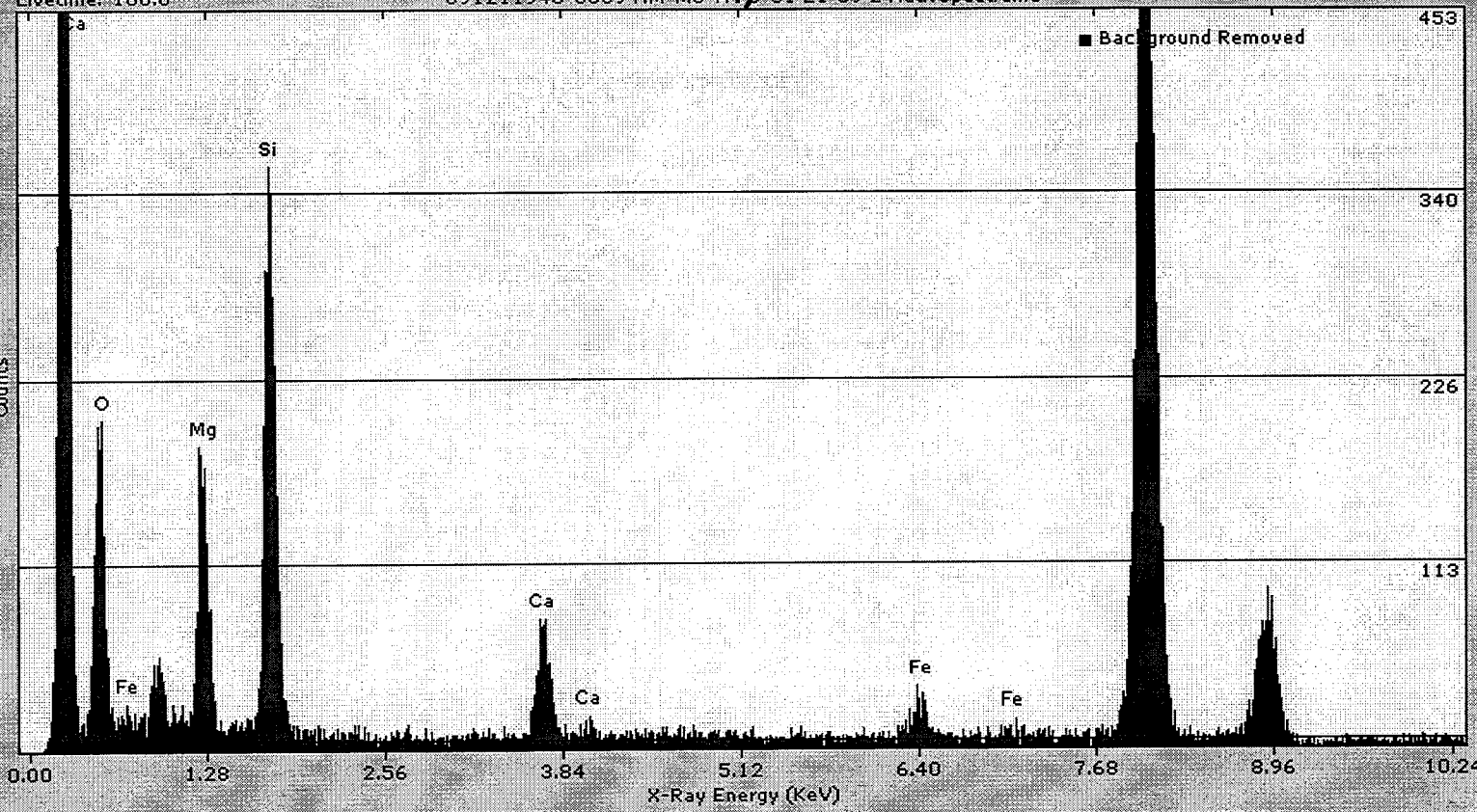


Quantitative Results for Spectrum3
Analysis: Thin Film Method: Standardless
Acquired 04-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.14	1.27	58.33	0.00		0.0000	0.0	85.8	691.20
Magnesium	29.55	0.81	24.59	48.99	(MgO)	0.3886	1321.0	95.5	1323.82
Silicon	23.13	0.64	16.66	49.48	(SiO2)	0.2890	1208.7	101.4	1293.61
Iron	1.18	0.03	0.43	1.52	(FeO)	0.0088	51.0	146.1	114.60
Total	100.00			100.00					

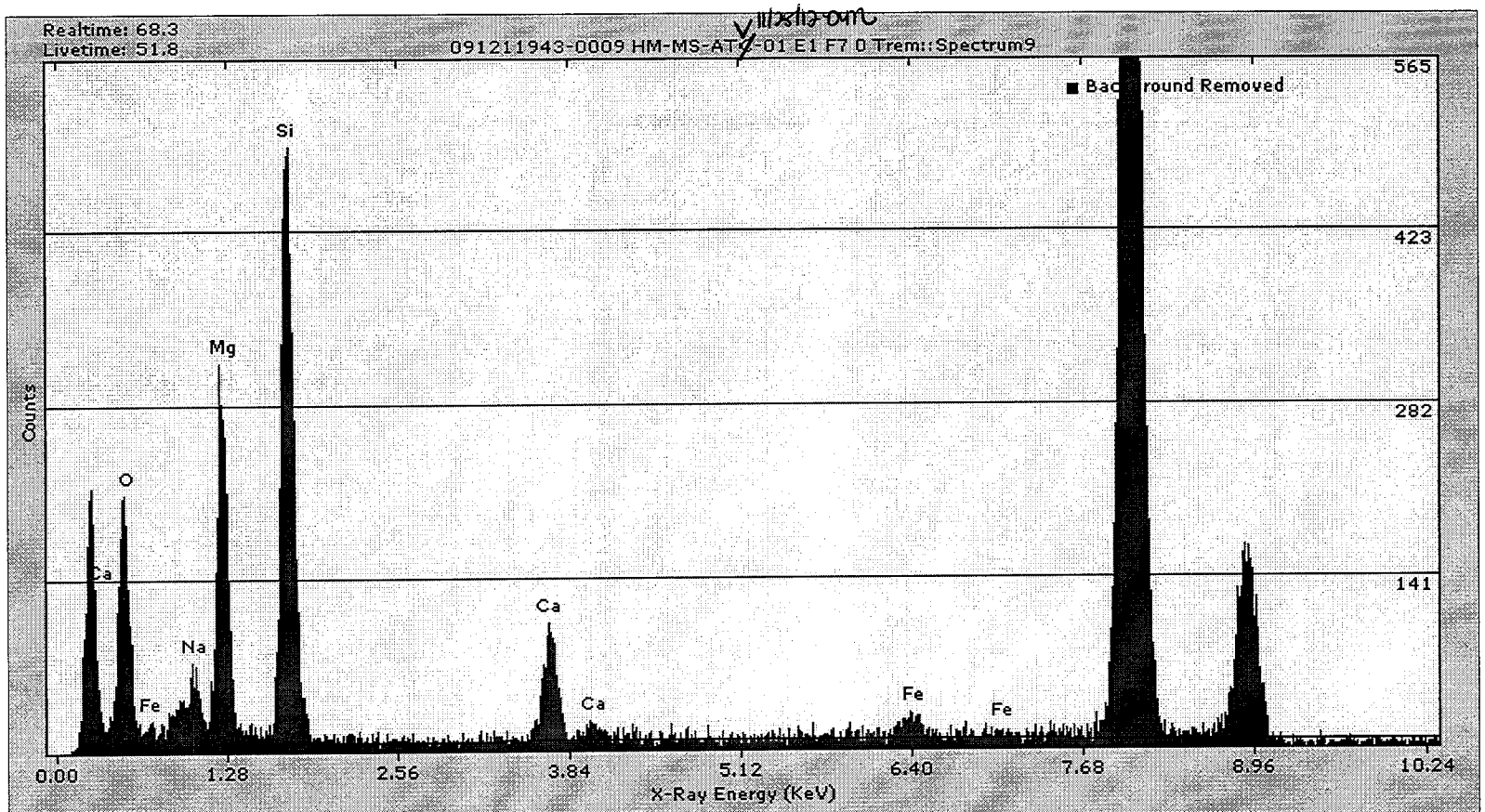
Realtime: 114.4
Livetime: 100.0

091211943-0009 HM-MS-ATE-01 E1 C9 2 Act:Spectrum5



Quantitative Results for Spectrum5
Analysis: Thin Film Method: Standardless
Acquired 04-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.61	0.92	60.66	0.00		0.0000	0.0	85.8	1509.29
Magnesium	16.56	0.33	14.19	27.46	(MgO)	0.2333	1258.2	95.6	1346.81
Silicon	28.74	0.57	21.31	61.49	(SiO2)	0.3799	2552.5	101.4	2782.66
Calcium	5.66	0.11	2.94	7.92	(CaO)	0.0531	522.1	122.2	675.35
Iron	2.43	0.05	0.90	3.12	(FeO)	0.0177	177.6	146.1	243.10
Total	100.00			100.00					



Quantitative Results for Spectrum9
Analysis: Thin Film Method: Standardless
Acquired 04-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.06	1.36	59.44	0.00		0.0000	0.0	85.8	1595.72
Sodium	3.24	0.05	2.91	4.37	(Na2O)	0.0489	331.9	92.6	500.25
Magnesium	16.88	0.26	14.34	28.00	(MgO)	0.2585	2181.1	95.5	2250.13
Silicon	27.67	0.43	20.34	59.19	(SiO2)	0.3904	4167.8	101.4	4231.89
Calcium	4.71	0.07	2.43	6.59	(CaO)	0.0451	738.4	122.2	888.12
Iron	1.44	0.02	0.53	1.85	(FeO)	0.0109	178.9	146.1	234.45
Total	100.00			100.00					

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 04, 2012

Image Number: 011337

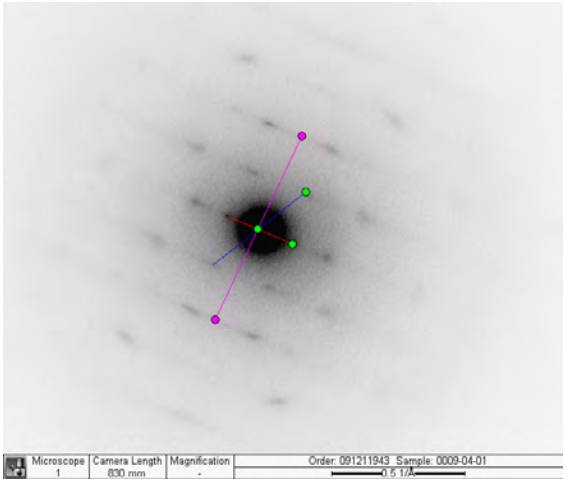
Reference / Sample Number: 0009

Preliminary ID: Chrysotile

Camera Constant: 2.964e-003 **1/A Pixels**

Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.237**	5.3	**5.06**	**5.56**
Vector Angle:	**61.3**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.567**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.533**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 04, 2012

Image Number: 011338

Sample Number: 0009-04-01

Preliminary ID: Actinolite

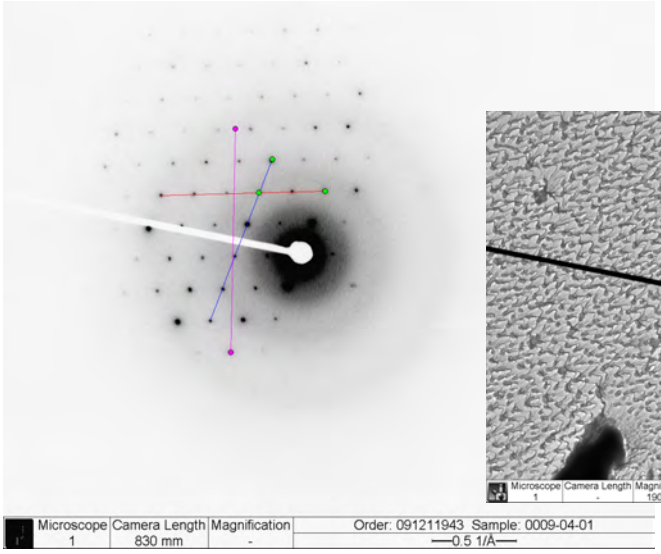
Camera Constant: 2.964e-003 **1/A Pixels**

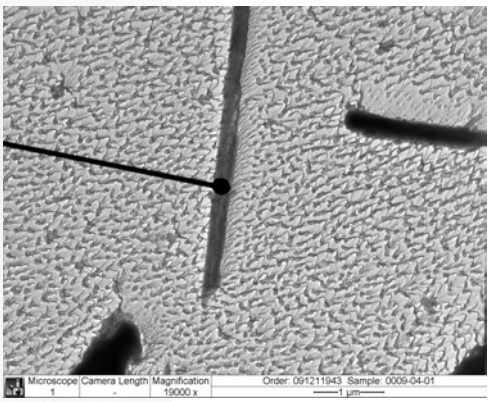
Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.282**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**5.109**	5.102	**4.847**	**5.357**
d1 or hkl (Camera K/slant vector dist.):	**4.879**	4.882	**4.638**	**5.126**
Ratio of hk0/hkl:	**1.047**	1.048	**0.996**	**1.100**
Vector Angle:	**67.9**	68.030	**64.629**	**71.432**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: **[3 1 2]**





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By:

F Craig

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AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 04, 2012

Image Number: 011340

Sample Number: 0009-04-01

Preliminary ID: Tremolite

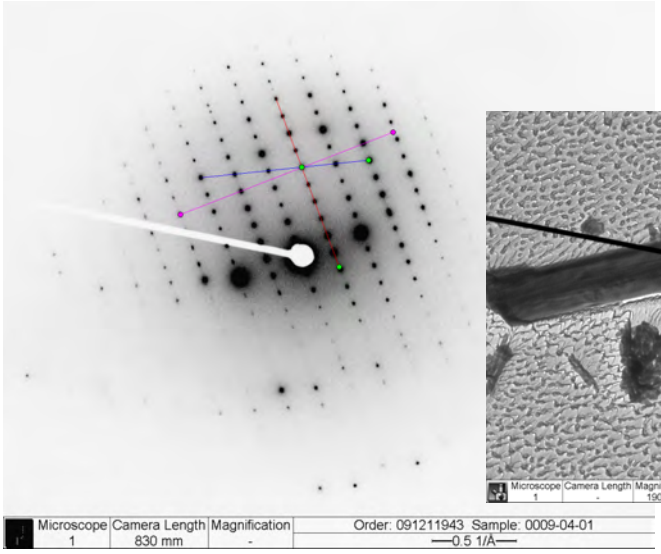
Camera Constant: 2.964e-003 **1/A Pixels**

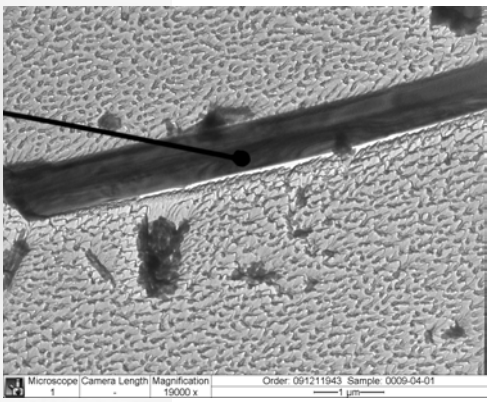
Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.169**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**4.700**	4.753	**4.515**	**4.991**
d1 or hkl (Camera K/slant vector dist.):	**5.023**	5.092	**4.837**	**5.347**
Ratio of hk0/hkl:	**0.936**	0.933	**0.886**	**0.980**
Vector Angle:	**75.4**	75.300	**71.535**	**79.065**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **TREMOLITE**

With a Zone Axis of: [**0 -1 0**]





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By:

F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
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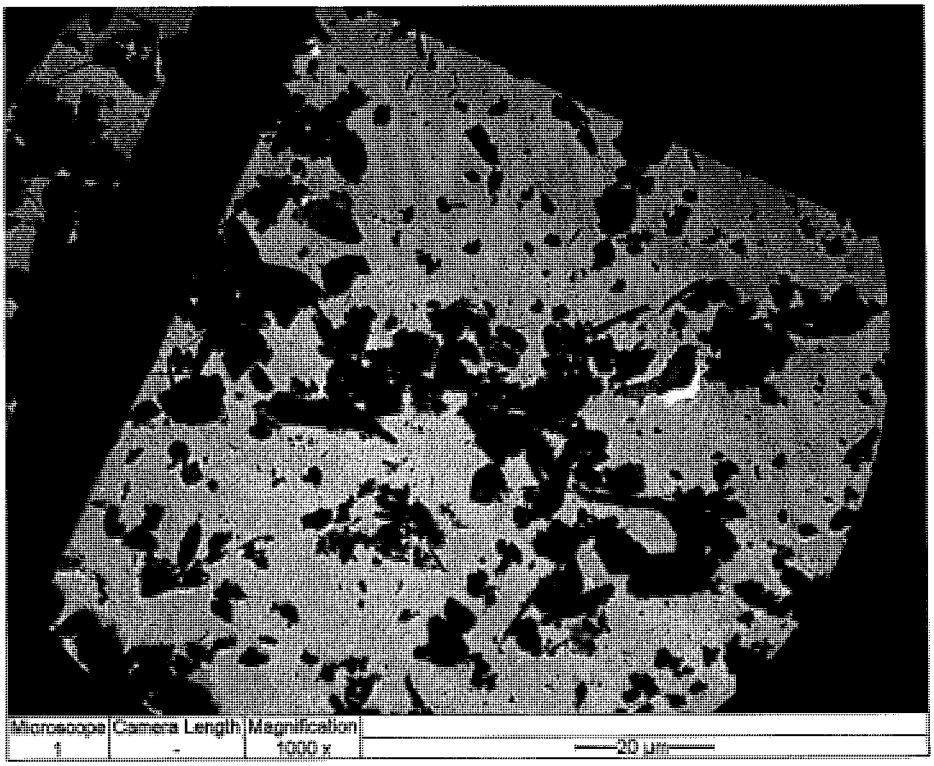
EMSL Analytical, Inc.

Photomicrograph Report

EMSL ANALYTICAL, INC.



Micrograph Information

Sample ID:	0009
Order ID:	091211942
Image Number:	11342
Mineral Type:	NRA
Date:	11/4/2012
Magnification:	1000
Microscope:	04-01

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TEL: (800) 220-3675 www.EMSL.com

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0010**	Volume (L):	630	Scope:	09-02
Customer Sample:	HM-MS-ATV-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	0
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	E, 4-6	Analysis Date:	9/20/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	12	none	3:1	5:1	
GO Analyzed:	0				OVERLOADED
Level of Analysis Chrysotile:	CD~~Q~~ 11/20/12 DJM	Min Length:	> 5	micron	15%
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0010**	Volume (L):	630	Scope:	04.05
Customer Sample:	HM-MS-ATV-02	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	~~8~~ 19Kx DM 11/28/12
Pore Size (micron):	0.45	Grid Box :	0412- ~~121001~~ ERRG-01 DM	Analyzed By:	RD
EFA (mm^2):	385	Grid Location:	~~E.4.6~~ D 1-4 11/28/12	Analysis Date:	11.4.12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:
Particulate loading 15-20%.

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
D2	G3	MD11	1		17.5	7.5	CM	CH			
	↓	MB		1	17.5	0.25	CM	CH			
	↓	B	0	0	6.5	0.32	CM	~~CH~~ 11/28/12 DM	GB non-ct. GB		
	↓	B	0	0	12.5	0.6	CD	~~CH~~	GB nonctgb		
	G5	MD11	2		19.2	19.0	ADX	ACT			
	↓	MF		2	~~19.2~~ 6.5 RD 11.29.12	1.0	ADX	ACT		Asbestos 20	Y
	C10	MD22	3		10.5	10.0	CM	CH			
	↓	MB		3	10.5	1.0	CM	CH	3 4		
	↓	MB		4	5.1	0.25	CM	CH			
	↓	B	4	5	7.0	1.5	CM	CH		Asbestos 22	Y

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0010**	Volume (L):	630	Scope:	04-05
Customer Sample:	HM-MS-ATV-02	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	~~19Kx~~ 11/28/12 DM
Pore Size (micron):	0.45	Grid Box :	0412- ~~121001~~ ERRG-01 11/28/12 DM	Analyzed By:	RD
EFA (mm^2):	385	Grid Location:	~~E, 4-6~~ D, 1-4	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		**Comments:**
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
	D5	B	5	6	24.1	3.25	CM	CH			
		B	6	7	6.1	1.2	CM	CH			
		B	7	8	28.7	2.0	CD	CH			
		MD11	8		9.8	7.5	CD	CH			
		MF		9	9.8	0.45	CD	CH			
		MD11	9		15.0	10.5	CD	CH			
		MF		10	15.0	2.0	CD	CH			
		MD11	10		24.5	14.7	CD	CH			
		MB		11	24.5	0.75	CD	CH			
	J9	B	11	12	11.5	0.55	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0010**	Volume (L):	630	Scope:	04-05
Customer Sample:	HM-MS-ATV-02	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	~~19~~ 19 Kx 11/28/12 DM
Pore Size (micron):	0.45	Grid Box :	0412-~~121001~~ ERRG-01	Analyzed By:	RD
EFA (mm^2):	385	Grid Location:	~~E, 4-6~~ D, 1-4 11/28/12 DM	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~X~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
		B	12	13	5.65	0.2	ADX	Act			
		B	13	14	16.25	3.0	CD ~~ADX~~ RD 11-29	~~A~~ CH			
		MD11	14		9.2	6.0	CD	CH			
		MB		15	5.75	0.2	CD	CH			
		MD11	15		6.0	1.5	CD	CH			
		MB		16	6.0	0.6	CD	CH			
	J7	B	16	17	31.2	3.0	CD	CH			
		MD11	17		9.5	4.65	CD	CH			
		MB		18	8.0	0.4	CH	CH			
		F	18	19	7.5	0.15	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0010**	Volume (L):	630	Scope:	04-05
Customer Sample:	HM-MS-ATV-02	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	~~19~~ 19kx 11/28/12 DM
Pore Size (micron):	0.45	Grid Box :	0412 - ~~121001~~ ERRG-01 11/28/12 DM	Analyzed By:	RD
EFA (mm^2):	385	Grid Location:	~~E, 4-6~~ D 1-4	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~X~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
		MD11	19		17.5	13	~~CD~~ ADX RD 11/29	~~CH~~ Act			
		MF		20	10.0	0.25	~~CD~~ ADX RD 11/29	~~CH~~ Act			
		MD11	20		5.1	2.0	CD	CH			
		MB	~~20~~	21	5.25	0.3	CD	CH			
	J5	MD11	21		20	10.5	CD	CH			
		MB		22	20	3.75	CD	CH			
		F	22	23	5.25	0.1	CD	CH			
		B	23	24	15.8	0.65	CD	CH			
		B	24	25	6.0	0.55	CD	CH			
		B	25	26	11.2	2.0	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0010**	Volume (L):	630	Scope:	04-05
Customer Sample:	HM-MS-ATV-02	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	~~9~~ 19Kx 11/28/12 DAM
Pore Size (micron):	0.45	Grid Box:	0412- ~~121001~~ ERRG-01	Analyzed By:	RD
EFA (mm^2):	385	Grid Location:	~~E, 4 6~~ D 1-4 11/28/12 DAM	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DAM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
	↓	MD+O	RD 11-26 ~~150~~	27 ~~6.5~~	15.0	6.5	CD	CH	GB		
D3	A10	MD22	27		25	15.0	CD	CH			
		MF		28	7.0	0.5	CD	CH	28		
		MB		29	5.5	0.1	CD	CH			
		F	28	30	5.1	0.1	CD	CH	29		
	↓	F	29	31	6.5	1.2	ADX	ACT			
	B2	MD11	30		18.5	1.5	CD	CH			
		MF		32	18.5	0.15	CD	CH			
		B	31	33	9.2	1.75	ADX	ACT			
		MC11	32	34	26	15.0	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0010**	Volume (L):	630	Scope:	04-05
Customer Sample:	HM-MS-ATV-02	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19Kx
Pore Size (micron):	0.45	Grid Box :	0412- ~~12100T~~ ERR2-01 11/28/12 OM	Analyzed By:	RD
EFA (mm^2):	385	Grid Location:	~~E, 4-8~~ D 1-4	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 OM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
	C3	MD11	33		16.75	3.0	ADX	ACT			
	↓	MF		35	6.5	0.2	ADX	ACT			
		B	34	36	28.8	2.75	CD	CH			
		MD11	35		18.5	1.5	ADX	ACT			
		MF		37	18.5	0.35	ADX	ACT			
		MD11	36		17.5	2.0	CD	CH			
		MB		38	17.5	2.0	CD	CH			
		CC+1	37	39	6.5	3.8	CM	CH			
	A5	B	38	40	19.8	0.5	CM	CH			
		B	39	41	17.5	1.85	CM	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0010**	Volume (L):	630	Scope:	04-05
Customer Sample:	HM-MS-ATV-02	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	~~19kx~~ 11/28/12 DM
Pore Size (micron):	0.45	Grid Box :	0412- ~~121001~~ ERRG-01	Analyzed By:	RD
EFA (mm^2):	385	Grid Location:	~~E, 4-6~~ D, 1-4 11/28/12 DM	Analysis Date:	11/4/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
	↓	F	40	42	5.1	0.1	CD	CH			
	↓	MD+1	41		8.5	7.5	CD	CH			
	↓	MB		43	8.5	0.68	CD	CH			
	F5	MD11	42		15.9	1.0	CD	CH			
	↓	MB		44	15.9	0.15	CD	CH			
	↓	MD11	43		8.5	3.2	ADX	Act			
	↓	MF		45	8.5	0.75	ADX	Act	GB		
	↓	B	44	46	23.26	4.3	CD	CH			
	↓	B	45	47	18.26	4.7	CD	CH			
	↓	CC+1	46	48	7.45	4.3	CD	CH			

Energy Dispersive X-Ray Analysis Quantitative Spectra & Data

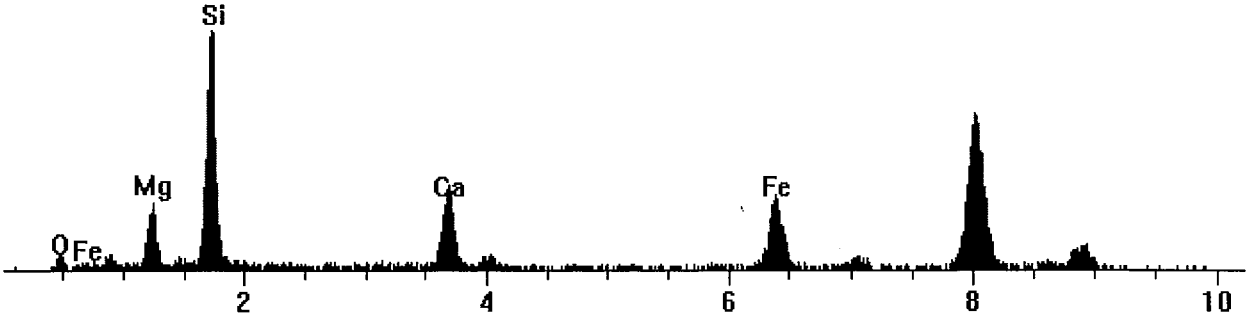
EMSL ANALYTICAL, INC.

File: C:\Program Files\PGT\Data\091211943-0010 Actinolite.pgt
Collected: November 04, 2012 14:47:38

Live Time:	80.54	Count Rate:	931	Dead Time:	33.98 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

091211943-0010 Actinolite.pgt

FS: 800



Energy Dispersive X-Ray Analysis Quantitative Spectra & Data

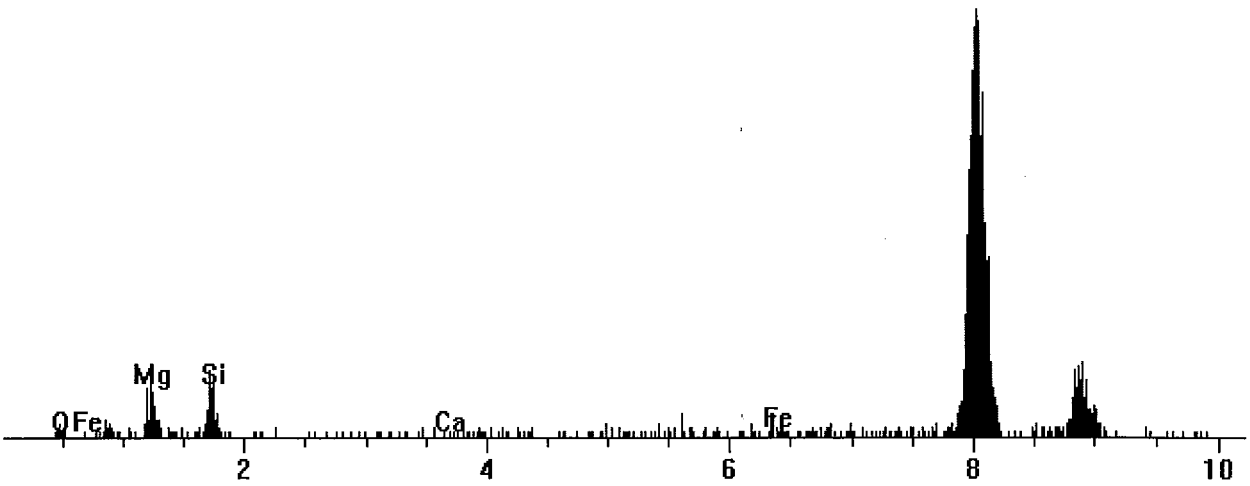
EMSL ANALYTICAL, INC.

File: C:\Program Files\PGT\Data\091211943-0010 Chrysotile.pgt
Collected: November 04, 2012 14:47:38

Live Time:	9.76	Count Rate:	998	Dead Time:	23.27 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

091211943-0010 Chrysotile.pgt

FS: 110



SAED INDEXING FORM

EMSL Order Number: 091211943-0010 **Date:** 11/4/2012
Image Number: Asbestos_020
Reference/Sample Number:
Preliminary ID: Fe Actinolite
Camera Constant: 749.8 **Å Pixels**
Calibration Reference:

	Measured	Reference	-5%	+5%
Inter-row Spacing:	5.024	5.3	5.035	5.565
d2 or hk0 (Camera K/zero row dist.):	8.781	8.429	8.008	8.850
d1 or hkl (Camera K/slant vector dist.):	4.316	4.482	4.258	4.706
Ratio of hk0/hkl:	2.035	1.881	1.933	2.137
Vector Angle:	64.57	64.57	61.34	67.80

From SAED Reference Book, 'unknown' diffraction pattern was found to be that of: Actinolite
With a Zone Axis of: 1 -1 2
Indexed by: RD
Preliminary Identification was: _X__ CORRECT
____ INCORRECT

EMSL Analytical 200 Rt 130 North Cinnaminson NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974
www.EMSL.com

Asbestos_020_indexed
2:52:30 PM 11/4/2012

5 (1/Å)
Cam Len: 0.2200 m

SAED INDEXING FORM

EMSL Order Number: 091211943-0010 **Date:** 11/4/2012
Image Number: Asbestos_022
Reference/Sample Number:
Preliminary ID: Chrysotile
Camera Constant: 749.8 **Å Pixels**
Calibration Reference:

	Measured	Reference	-5%	+5%
Inter-row Spacing:	5.182	5.3	5.035	5.565
d2 or hk0 (Camera K/zero row dist.):	6.994	7.32	6.954	7.686
d1 or hkl (Camera K/slant vector dist.):	4.428	4.58	4.351	4.809
Ratio of hk0/hkl:	1.579		1.500	1.658
Vector Angle:	60	60	57.00	63.00

From SAED Reference Book, 'unknown' diffraction pattern was found to be that of: Chrysotile
With a Zone Axis of:
Indexed by: RD
Preliminary Identification was: _X__ CORRECT
____ INCORRECT

EMSL Analytical 200 Rt 130 North Cinnaminson NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974
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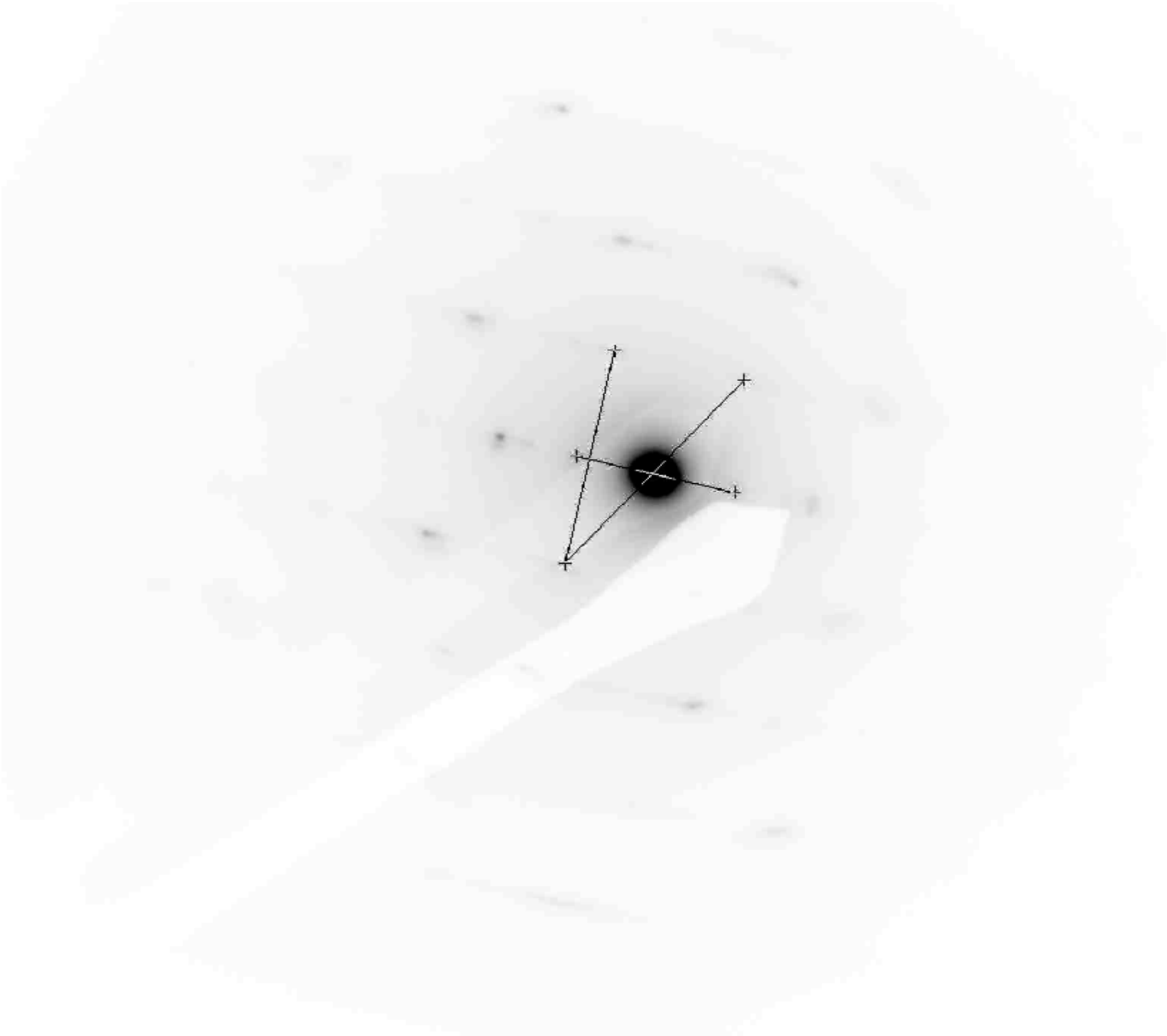

Asbestos_022_indexed
3:22:09 PM 11/4/2012

5 (1/Å)
Cam Len: 0.2200 m

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**09211943-0011**	Volume (L):	722	Scope:	09-0 2
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	F, 1-3	Analysis Date:	9/20/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	0				OVERLOADED
Level of Analysis Chrysotile:	CD~~Q~~ 11/20/12 DM	Min Length:	> 5	micron	30%
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943 ~~09241943~~-0011 11/28/12 DM	Volume (L):	722	Scope:	04·05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121001~~ 0412-ERRG-01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	~~F, 1-3~~ E, 1-4; K, 1-4	Analysis Date:	11·12·12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CDQ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments: Upon switching from E to K, sample loading increased from about 12% to about 25%.

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E1	D7	MD11	0 +	11/28/12 DM	16.2	6.7					
E1	D7	MB		0 + 11/28/12 DM	16.2	2.5		NAM			
E1	D7	MD++	0		44.5						
E1	D7	MB		0	7.8	.9		NAM			
E1	D7	MR22 ~~AMR~~		0	20.5 ~~18.3~~	18.3					
E1	D7	MR32		0	19.2	15.4					
E1	D7	MR++		0	14.3	11.6					
E1	D7	MD11	0	11/28/12 DM	52.3	8.2					
E1	D7	MB		0	41.7	3.1	CDQ	CH			
~~E1~~	~~D7~~										

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	09211943 ~~09211943-0011~~ 11/28/12 DM	Volume (L):	722	Scope:	04.05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	LM 11.12 ~~121001~~ 0412-ERRG-01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	LM 11.12 ~~F, 1-3~~ E 1-4, K 1-4	Analysis Date:	11.12.12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CDQ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E1	G5	MD11	~~3~~ 1	11/28/12 DM	17.8	6.1			3		
E1	G5	MB	11/28/12 DM	1 ~~3~~	15.7	.5	CDQ	CH			
E1	G5	MC11	~~4~~ 2	~~4~~ 2	50.5	27.4	CDQ	CH			
E1	I7	~~F~~	~~0~~	~~0~~	~~7.8~~	~~.28~~		~~TR~~	~~1~~	~~TGB~~ LM 11.12	
E1	I7	MD22	~~5~~ 0	11/28/12 DM	32.3	13.1			5		
E1	I7	MF		~~5~~ 0	8.4	.29		NAM	6		
E1	I7	MR11		~~6~~ 0							
E1	I7	MD~~B~~	~~6~~ 0	11/28/12 DM	17.7	14.6			1		
E1	I7	MB		11/28/12 DM ~~7~~ 0	15.8	2.5		NAM			
E1	I7	MR53		~~8~~ 0	10.9	6.1					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	09211943 11/28/12 DM ~~09211943~~-0011	Volume (L):	722	Scope:	04-05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	LM 11.12 ~~121001~~ ~~EH~~12-ERRG-01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	LM 11.12 ~~F, 1-3~~ E 1-4, K 1-4	Analysis Date:	11.13.12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CDQ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E1	I7	MD11	~~1~~ 0 11/28/12 DM		10.2	4.3			9		
E1	I7	MF		~~1~~ 0 DM	10.2	.7		NAM			
E2	LM 11.13 ~~G7~~ F3	MD11	~~8~~ 3 11/28/12 DM		23.8	4.2			10		
E2	F3	MB	~~21.1~~	~~24~~ ~~to~~ 3 LM 11.13	21.1	2.1	CDQ	CH		~~09211943~~ 11/28/12 -035 DM	11/28/12 DM
E2	F3	MD11	~~1~~ 0 11/28/12 DM		33.5	26.1					
E2	F3	MB		~~1~~ 0	26.2	5.0	CDQ	CH	11		
E2	D8	MD11	~~10~~ 4 11/28/12 DM		18.1	4.6					
E2	D8	MB		~~1~~ 4	15.2	1.1	CDQ	CH			
E2	D8	MC44	~~1~~ 5 11/28/12 DM	~~1~~ 5	38.4	26.5	CDQ	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943 ~~09211943~~-0011 11/28/12 OM	Volume (L):	722	Scope:	04-05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	11.13 ~~121001~~ 0412-ERRG-01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	11.13 ~~F, 1-3~~ E 1-4, K 1-4	Analysis Date:	11.13.12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11		none	3:1	5:1	
GO Analyzed:	11					
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 OM		Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E2	D8	MD11	~~12~~ 6 11/28/12 OM		25.4	15.3					
E2	D8	MB		~~14~~ 6	18.3	.90	CD	CH			
E2	D8	MD11	~~13~~ 0 11/28/12 OM		19.7	8.3					
E2	D8	MB		~~15~~ 0	19.5	4.7		NAM			
E2	D8	MD22	~~14~~ 7 11/28/12 OM		22.2	12.3					
E2	D8	MB		~~16~~ 7	21.5	2.5	CD	CH	16		
~~E2~~	~~D8~~	MB		~~17~~ 8 11/28/12 OM	6.8	.7	CD	CH	17		
E2	I2	MD11	8 ~~15~~ 11/28/12 OM		58.3	11.3					
E2	I2	MB		~~18~~ 9	57.7	1.3	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	09211943 11/28/12 DM ~~09211943~~-0011	Volume (L):	722	Scope:	04.05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	11.13 ~~121001~~ 0412.ERRG.01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	11.13 ~~F, 1-3~~ E 1-4, K 1-4	Analysis Date:	11.13.12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E2	I2	MD11	~~16~~ 9 11/28/12 DM		62.1	7.8					
E2	I2	MB		~~19~~ 10	62.1	3.1					
E2	I2	MD11	~~17~~ 10 11/28/12 DM								
E2	I2	MB		~~20~~ 11	9.9	.31	CD	CH			
E3	F4	MD11	~~18~~ 11 11/28/12 DM		36.5	7.3					
E3	F4	MB		~~21~~ 12 11/28/12 DM	36.5	4.6	CD	CH			
E3	F4	F	~~19~~ 0	~~22~~ 0	8.1	.63		NAM			
E3	C10	MD11	~~20~~ 12 11/28/12 DM		42.4	36.5					
E3	C10	MB		~~23~~ 13 11/28/12 DM	36.4	.72	CD	CH			
* E3	C10	F	~~21~~ 13	~~24~~ 14	9.8	1.7	ADX	AC		09211943 -010	Yes

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	09211943 11/28/12 DM ~~09211943~~-0011	Volume (L):	722	Scope:	04.05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	LM 11.15 ~~121001~~ 0412-ERRG-01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	LM 11.15 ~~F, 1-3~~ E 1-4, K 1-4	Analysis Date:	11.15.12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CDQ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K2	D3	MD21	0		14.3	4.8			NCGB		
		MB		0	12.5	4.8	CD	CH			
		MR10		0	2.5	2.2					
		MD11	~~2~~ 14	11/28/12 DM	47.8	31.3			29		
		MB		~~2~~ 0	16.2	.81	NAM	NAM	25 30		
		MB		~~2~~ 15	11.8	.52	CD	CH	27 28 26		
		MB	11/28/12 DM	~~2~~ 16	11.3	2.0	CDQ	CH			
		MB		~~2~~ 0	11.2	2.1		NAM			
		MR33		~~2~~ 17	32.5	15.3	CD	CH			
		MR33		~~3~~ 18	18.1	11.7	CDQ	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	09211943 ~~09211943~~-0011	Volume (L):	722	Scope:	04.05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	11.15 ~~121001~~ 0412.ERRG.01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	11.15 ~~F, 1-3~~ E1-4, K1-4	Analysis Date:	11.15.12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~O~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K2	D3	MD11	~~2~~ 3 15	11/28/12 DM	13.4	13.2					
		MB	DM 11/28/12	~~3~~ 19	13.2	.90	CD	CH			
		B	~~2~~ 4 0	~~3~~ 2 0	5.2	.51		NAM			
		MD22	~~2~~ 5 16	11/28/12 DM	17.8	10.5					
		MB		~~3~~ 3 20	16.1	.49	CD	CH			
		MB	11/28/12 DM	~~3~~ 4 21	10.8	2.9	CD	CH			
		MD11	~~3~~ 6 0		10.9	5.8					
		MB		~~3~~ 5 0 11/28/12 DM	10.9	.85	ADX	~~NAMLA~~ NRA 11/28/12 DM		09211943 -015	Yes

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	09211943 ~~09211943-0011~~ 11/28/12 DM	Volume (L):	722	Scope:	04.05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	11/15 ~~121001~~ ~~0412~~ ERRG-01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	11/15 ~~F, 1-3 E~~ ~~14~~, K 1-4	Analysis Date:	11.15.12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)	none	3:1	5:1
GO Required:	11				
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K2	D3	MD22	~~2~~/17 11/28/12 DM		17.2	8.75					
		MB		~~3~~/6	17.2	1.3		NAM			
		MB	11/28/12 DM	~~3~~/7 22	9.8	1.5	CD	CH			
		F	~~2~~/8 0 11/28/12 DM	~~3~~/8 0	5.7	.55	ADX	~~LA~~ NRA 11/28/12 DM			
		B	~~2~~/9 18	~~3~~/9 23	15.7	1.1	CD	CH			
		F	~~3~~/0 0	~~0~~/0	6.1	.49		NAM			
		MC66	0 11/28/12 DM	0	38.3	2.3	CD	CH	NGFB		
		MD11	~~3~~/1 0 11/28/12 DM		5.5	3.1					
		MB		~~4~~/1 0	5.5	1.0		NAM			
		B	19 ~~3~~/2	~~4~~/2 24	10.1	.65	CD	CH			

11/28/12 DM

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943 11/28/12 DM ~~09211943~~-0011	Volume (L):	722	Scope:	04.05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412- ~~121001~~ ERRG-01 11/28/12 DM	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	~~F, 1-3~~ E, 1-4; K, 1-4	Analysis Date:	11.15.12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K2	D3	B	20 ~~33~~	25 ~~43~~	7.7	3.2	CD	CH			
		CD31	0 ~~39~~ 11/28/12 DM		7.9	3.1					
		CF		0 ~~49~~	7.9	.63		NAM			
		MD22	21 ~~38~~ 11/28/12 DM		27	4.6					
		MB		26 ~~45~~	10.8	.92	CD	CH	47		
		MB	11/28/12 DM	27 ~~46~~	7.2	.47	CD	CH	47 46		
		MB21		0 ~~47~~	6.9	4.1		NAM			
		B	22 ~~36~~	28 ~~48~~	6.1	.70	CD	CH			
		MC11	23 ~~37~~ 11/28/12 DM		25.1	15.2	CD	CH			

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TEM Asbestos Count Sheet

EMSL Sample ID:	~~09211943~~ 09211943-0011 11/28/12 DM	Volume (L):	722	Scope:	04.05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	11.15 ~~121001~~ 0412 ERRG-01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	11.15 ~~F, 1-3~~ E1-4, K1-4	Analysis Date:	11.15.12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	11		none	3:1	5:1	
GO Analyzed:	11					
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K2	D3	MC ~~MD~~ 11	~~38~~ 21	~~49~~ 29	21.3	17.2	CD	CH			
		~~MF~~	11/28/12 DM	~~49~~	m 11.15						
		F	~~39~~ 0	~~58~~ 0	5.2	.52		NAM			
		MD11	~~60~~ 25	11/28/12 DM	18.3	6.1					
		MB		~~81~~ 30	18.3	1.5	CD	CH			
		MD11	~~41~~ 26	11/28/12 DM	20.1	11.5					
		MB		~~52~~ 31	18.1	1.0	CD	CH			
K2	G5	MD11	~~42~~ 27	11/28/12 DM	7.3	3.2					
		MB	11/28/12 DM	~~53~~ 32	7.3	.50	CD	CH			
		B	28 ~~43~~	~~59~~ 33	9.9	.82	CD	CH			

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TEM Asbestos Count Sheet

EMSL Sample ID:	09211943 ~~09211943~~-0011 11/28/13 DM	Volume (L):	722	Scope:	04.05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	LM 11/15 ~~121001~~ 0412ERRG-01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	LM 11/15 ~~F, 1-3~~ ~~E 1-4~~, K 1-4	Analysis Date:	11.15.12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/13 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K2	G5	MD33	~~4~~ 29		48.5	18.2			56		
1	1	MB		~~55~~ 34	48.5	.95	ADX	AC			
		MB	11/28/13 DM	~~56~~ 35	8.2	.25	ADX	AC	56 57 55		
		MB		~~57~~ 36	6.1	.6	CD	CH	LM 11/15		
		~~MB~~		~~58~~	LM 11/15						
		MD11	~~45~~ 0	11/28/13 DM	33.7	11.3					
		MB		~~58~~ 0	29.1	.95		NAM			
1	1	B	~~46~~ 30	~~57~~ 37	8.5	.35	CD	CH			
			11/28/13 DM								

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943 ~~09211943~~-0011	Volume (L):	722	Scope:	04.05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	11.15 ~~121001~~ 0412-ERRG-01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	11.15 ~~F, 1-3~~ E 1-4, K 1-4	Analysis Date:	11.15.12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11		none	3:1	5:1	
GO Analyzed:	11					
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DM		Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K2	G5	MD44	~~47~~ 31		~~43.0~~ ~~32.1~~	~~23.8~~ ~~2.7~~	~~CD~~	~~CH~~	60		
		MB		~~60~~ 38	32.1	2.7	CD	CH	63 61		
		MB	11/28/12 DM	~~69~~ 39	12.2	1.5	CD	CH	62		
		MB		~~62~~ 40	6.7	1.4	CD	CH			
		MB		~~63~~ 41	6.3	.80	CD	CH			
		MD22	~~48~~ 32	11/28/12 DM	21.1	17.8					
		MB		~~64~~ 42	17.7	.58	ADX	AC			
		MB	11/28/12 DM	~~65~~ 43	12.3	2.5	CD	CH			
		B	~~49~~ 0	~~66~~ 0	6.6	1.2		NAM			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	09121943 11/28/12 DM ~~09211943-0011~~	Volume (L):	722	Scope:	CY·CS
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	LM 11·15 ~~121001~~ 0412-ERRG·01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	LM 11·15 ~~F, 1-3~~ ~~K~~ 1-4	Analysis Date:	11·15·12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)	none	3:1	5:1
GO Required:	11				
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K2	G5	MD11	~~5~~ 0		8.2	5.3					
		MB	11/28/12 DM	~~67~~ 0	8.2	1.3		NAM			
		MD22	~~5~~ 33		15.9	13.4					
		MB	11/28/12 DM	~~68~~ 44	15.6	.51	ADX	AC			
		MF ~~MB~~ LM 11/15	11/28/12 DM	~~69~~ 0	10.1	1.7		NAM			
	H8	MD22	~~5~~ 34		35.1	25.4			71 70		
				~~70~~ 0	22.7	2.2		NAM			
			11/28/12 DM	~~71~~ 45	15.6	3.1	CD	CH	72		
				~~72~~ 46	8.1	1.1	ADX	AC			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943 11/28/12 DM ~~09211943~~-0011	Volume (L):	722	Scope:	04·05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	LM 11·15 ~~121001~~ 0412·ERRG·01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	LM 11·15 ~~F, 1-3~~ E 1-4, K1-4	Analysis Date:	11·15·12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K2	H8	MD11	~~5~~ 0		9.2	2.5					
		MF	11/28/12 DM	~~7~~ 3 0	9.2	.85		NAM			
		MD11	~~5~~ 4 0		11.0	2.8					
		MB	11/28/12 DM	~~7~~ 9 0	11.0	.47	ADX	~~LA~~ NRA 11/28/12 DM			
		MD11	~~5~~ 35		16.2	5.4					
		MB	11/28/12 DM	~~7~~ 5 47	12.1	2.1	CD	CH			
		MD22	~~5~~ 6 36		30.0	29.8					
				~~7~~ 6 48	29.3	2.1	CD	CH	77 76		
			11/28/12 DM	~~7~~ 7 49	11.8	.41	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943 11/28/12 DM ~~09211943~~-0011	Volume (L):	722	Scope:	04.05
Customer Sample:	HM-MS-ATV-03	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	LM 11.15 ~~121001~~ 0412.ERRG.01	Analyzed By:	LM
EFA (mm^2):	385	Grid Location:	LM 11.15 ~~F, 1-3~~ E1-4 K1-4	Analysis Date:	11.15.12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
~~E3~~ K2	~~C10~~ H8	B	~~57~~ 37	~~78~~ 50	8.3	1.2	CD	CH			
K2	H8	MD+6	~~58~~ 38	11/28/12 DM	23.5	13.5					
		MB		~~79~~ 51	12.4	.58	CD	CH	80		
		MR+5	11/28/12 DM	~~80~~ 52	13.7	8.6	CD	CH			
		MD4~~2~~ 1	~~59~~ 0 LM 11.15		12.7	8.3			81		
		MF	11/28/12 DM	~~81~~ 0	6.3	.68		NAM			
		MD	~~60~~ 39		39.7	17.6					
		MF		~~82~~ 0	34.3	5.1		NAM	83		
		MB	11/28/12 DM	~~83~~ 53	10.6	3.1	CD	CH			
		MF		~~84~~ 0	6.4	.75		NAM	82		

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

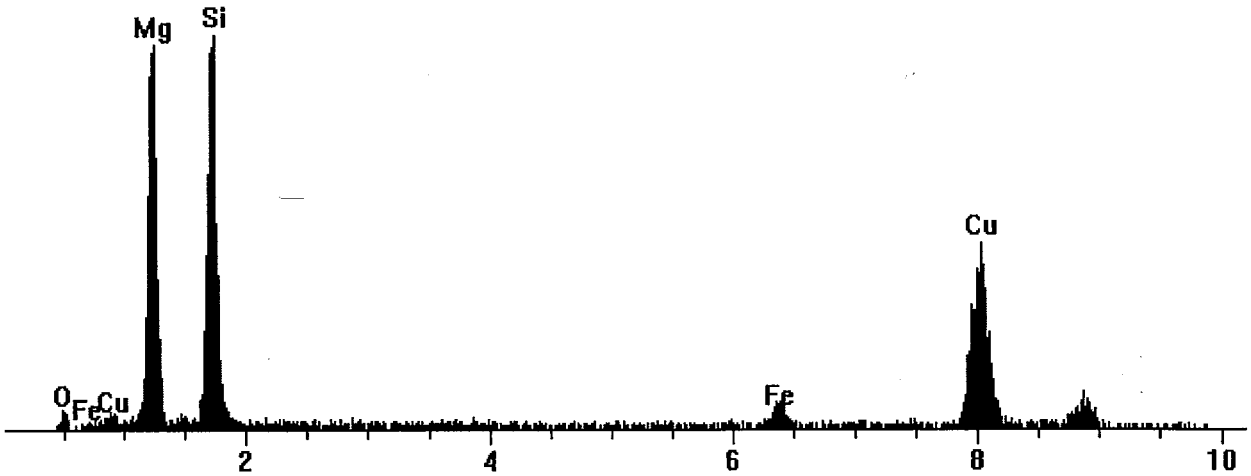
EMSL ANALYTICAL, INC.

File: L:\EDS Spectra\ERRG\091211943-0011 HM-MS-ATV-03 E2 F3 ~~8~~ 3 Chry.pgt 11/28/12 DM
Collected: November 13, 2012 09:14:25

Live Time:	419.03	Count Rate:	132	Dead Time:	5.89 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	49772.16				

■ 091211943-0011 HM-MS-ATV-03 E2 F3 ~~8~~ 3 Chry.pgt 11/28/12 DM

FS: 480



Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Cu	KA1	8.046	1.0576	0.00	0.00	0.0		
Mg	KA1	1.254	9.3254	52.56	43.62	60.3	MgO	87.14
Si	KA1	1.740	1.0000	5.80	4.17	5.8	SiO2	12.42
Fe	KA1	6.403	0.9581	0.35	0.13	0.2	FeO	0.45
O	KA1	0.523	0.0000	41.29	52.09	72.0		
Total			**0.3140**	**100.00**	**100.00**	**138.2**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Cu	KA1	22.4	0.6	21.7
Mg	KA1	25.4	0.6	24.8
Si	KA1	26.3	0.8	25.5
Fe	KA1	2.2	0.6	1.6
O	KA1	1.4	0.5	1.0

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

14 11/28/12 DM

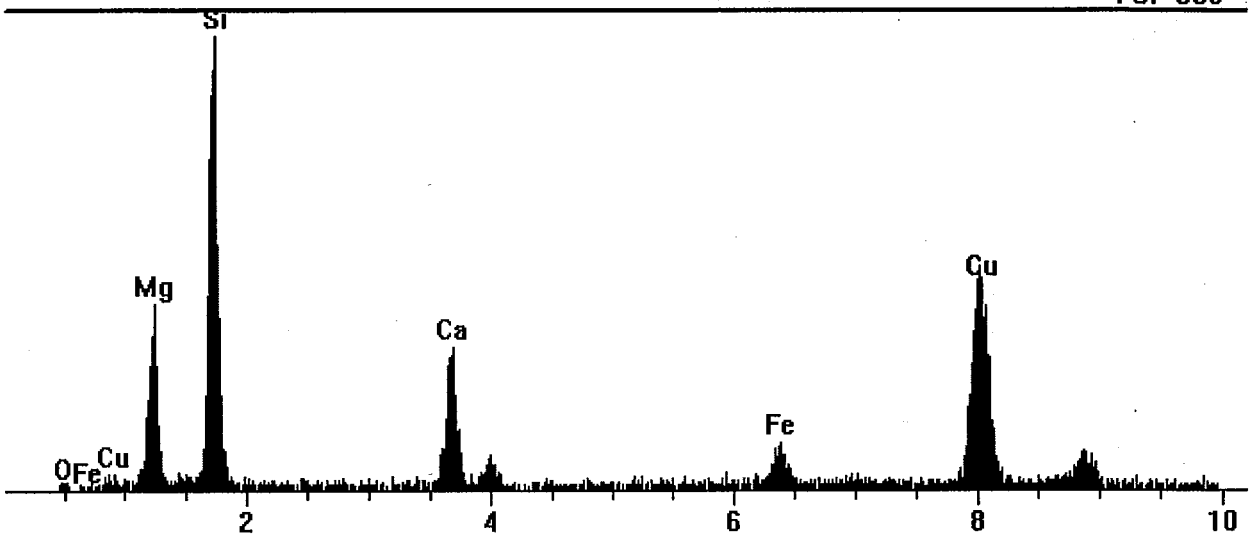
File: L:\EDS Spe...tra\ERRG\091211943-0011 HM-MS-ATV-03 E3 C10 ~~24~~ Act.pgt
Collected: November 13, 2012 09:14:25

Live Time:	269.95	Count Rate:	189	Dead Time:	7.60 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	28295.80				

14 11/28/12 DM

■ 091211943-0011 HM-MS-ATV-03 E3 C10 ~~24~~ Act.pgt

FS: 360



Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Cu	KA1	8.046	1.7370	0.00	0.00	0.0		
Mg	KA1	1.254	3.9144	21.51	19.49	24.9	MgO	35.67
Si	KA1	1.740	1.0000	16.45	12.90	16.5	SiO2	35.18
Fe	KA1	6.403	1.4277	2.66	1.05	1.3	FeO	3.42
Ca	KA1	3.691	2.7254	18.39	10.11	12.9	CaO	25.73
O	KA1	0.523	0.0000	40.99	56.45	72.0		
Total			**0.3378**	**100.00**	**100.00**	**127.5**	**Total**	**100.00**

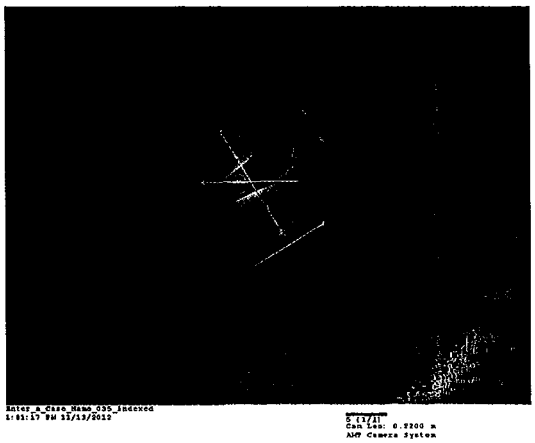
Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Cu	KA1	33.7	1.3	32.3
Mg	KA1	10.7	0.7	10.1
Si	KA1	30.9	0.8	30.1
Fe	KA1	4.4	1.0	3.4
Ca	KA1	13.1	0.8	12.3
O	KA1	1.1	0.4	0.7

SAED INDEXING FORM

1 11/13/12 pm

EMSL Order Number: 09211943 **Date:** 11/13/2012
Image Number: Enter_a_Case_Name_035
Reference/Sample Number: 0011
Preliminary ID: chrysotile
Camera Constant: 749.8 **Å Pixels**
Calibration Reference:

	Measured	Reference	-5%	+5%
Inter-row Spacing:	5.170	5.3	5.035	5.565
d2 or hk0 (Camera K/zero row dist.):	7.148	7.32	6.954	7.686
d1 or hkl (Camera K/slant vector dist.):	4.384	4.58	4.351	4.809
Ratio of hk0/hkl:	1.630			
Vector Angle:	60	60	57.00	63.00



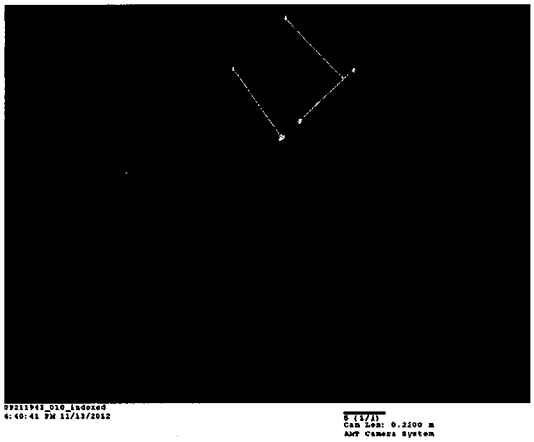
From SAED Reference Book, 'unknown' diffraction pattern was found to be that of: chrysotile
With a Zone Axis of:
Indexed by: L. McCluskey-Eissing
Preliminary Identification was: _X__ CORRECT
____ INCORRECT

EMSL Analytical 200 Rt 130 North Cinnaminson NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974
www.EMSL.com

SAED INDEXING FORM

EMSL Order Number:	09211943	**Date:**	11/13/2012
Image Number:	09211943_010		
Reference/Sample Number:	0011		
Preliminary ID:	actinolite		
Camera Constant:	749.8	**Å Pixels**	
Calibration Reference:			

	Measured	Reference	-5%	+5%
Inter-row Spacing:	5.060	5.278	5.014	5.542
d2 or hk0 (Camera K/zero row dist.):	8.436	8.429	8.008	8.850
d1 or hkl (Camera K/slant vector dist.):	4.978	4.931	4.684	5.178
Ratio of hk0/hkl:	1.695			
Vector Angle:	83.54	83.54	79.36	87.72



From SAED Reference Book, 'unknown' diffraction pattern was found to be that of: actinolite
With a Zone Axis of: [1 1 2]
Indexed by: L. McCluskey-Eissing
Preliminary Identification was: _X__ CORRECT
____ INCORRECT

EMSL Analytical 200 Rt 130 North Cinnaminson NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974
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ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0012**	Volume (L):	704	Scope:	09-02
Customer Sample:	HM-MS-ATV-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	9/20/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	0				OVERLOADED
Level of Analysis Chrysotile:	CDØ 11/20/12 DM	Min Length:	> 5	micron	25%
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0012**	Volume (L):	704	Scope:	04-03
Customer Sample:	HM-MS-ATV-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~ 0.0129 RD 11.25.12
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	P. Peterson
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	10/31/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

PK 11/1/12

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F ~~K4~~	J7	MD11	0		~~8.3~~	~~4.5~~	11/28/12 DM				
		MB		0	~~8.3~~	~~0.6~~	CDQ	CH			
		MD11	1		7.0	1.9					
		MB		1	6.7	1.1	CDQ	CH		03509	
		F	2	2	14.6	1.5	ADX	AC		03510	Y
		B	3	3	10.6	1.5	CD	CH			
		B	4	4	10.2	2.0	CD	CH			
		MD11	5		21.0	17.0					
		MB		5	16.0	2.0	CD	CH			
		MD11	6		10.5	4.0					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0012**	Volume (L):	704	Scope:	04-03
Customer Sample:	HM-MS-ATV-04	Prepped By:	PK	GO area (mm2):	~~.0182~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	PHerrison
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

PK 11/1/12

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F ~~K4~~	~~J4~~	MB		6	7.3	0.7	ADX	AC			
	G10	B	0	0	5.6	0.3	~~CD~~ 11/28/12 DM	CH			
		MD11	7		15.7	9.5	/				
		MF		7	15.7	1.4	ADX	AC			
		MD11	8		27.0	22.0					
		MB		8	8.3	0.5	CD	CH			
		MD11	9		35.0	27					
		MB		9	11.8	0.8	CD	CH			
		MD11	10		8.5	5.0					
		MB		10	8.1	0.5	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0012**	Volume (L):	704	Scope:	04-03
Customer Sample:	HM-MS-ATV-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	PHansen
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		**Comments:**
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F4	G10	MD22	11		400 ~~400~~ PK 11/1/12	20.0			11		
		MB		12	6.0	0.3	CD	CH	12		
		MP		12	5.5	0.5	ADX	AC			
	F4	F	12	13	11.3	2.0	ADX	AC			
		B	0	0	8.3	1.5	~~CD~~ 11/28/12 DM	~~CH~~			
		MD22	13		12.5	2.0			15		
		MF		14	11.0	0.5	ADX	AC	14		
		MF		15	5.1	0.3	ADX	AC			
		MD11	14		10.0	5.5					
		MB		16	7.0	0.4	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0012**	Volume (L):	704	Scope:	04-03
Customer Sample:	HM-MS-ATV-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	Pflemmer
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments: * Fiber contains elevated levels of Mg

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F4	F4	B	15	17	8.0	1.7	CD	CH			
↓	↓	B	16	18	22.0	0.4	CD	CH			
	E6	MD11	17		23.0	14.0					
		MB		19	10.3	0.8	CD	CH			
		F	18	20	8.0	0.4	ADX	AC			
		MD11	19		12.5	6.0			*		
		MF		21	10.0	0.6	ADX	NRA ~~AC~~ DM 11/28/12		03512	Y
		MD11	20		50.0	20.0					
		MB		22	14.0	2.0	CD	CH			
↓	↓	B	21	23	9.9	1.5	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0012**	Volume (L):	704	Scope:	04-03
Customer Sample:	HM-MS-ATV-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	P Henrsen
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F4	D2	MD11	22		7.5	4.0					
		MB	~~6~~ 24	~~0~~	6.5	0.3	CD	CH			
		MD22	23		12.5	10.0			25 26		
		MF		25	12.0	0.9	ADX	AC			
		MF		26	6.0	0.6	ADX	AC			
		MD11	24		35.0	30.0					
		MB		27	20.0	0.4	CD	CH			
		MD22	25		28.0	20.0					
		MB		28	9.0	1.2	CD	CH	28 29		
		MB		29	12.0	0.8	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0012	Volume (L):	704	Scope:	04-03
Customer Sample:	HM-MS-ATV-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	P Henrsen
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments: * Fiber contains elevated levels of Na & K

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F4	D2	B	26	30	11.4	0.9	CD	CH			
↓	B7	B	27	31	7.5	1.0	CD	CH			
↓	↓	F	28	32	12.5	2.0	ADX	NRA ~~AC~~ 11/28/12 DM	*		Y
↓	↓	F	29	33	11.5	1.5	ADX	AC			
↓	↓	F	30	34	7.0	0.7	ADX	AC			
↓	↓	B	31	35	6.0	0.8	CD	CH			
↓	↓	F	32	36	11.0	0.6	ADX	NRA ~~AC~~ 11/28/12 DM	*		
F5	J6	MD11	~~32~~ 33 11/28/12 DM		25.0	~~3.5~~ 3.0 PK 11/1/12					
↓	↓	MB	11/28/12 DM	37	21.5	3.0	CD	CH			
↓	↓	B	34 ~~33~~	38	9.5	1.7	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0012	Volume (L):	704	Scope:	04-03
Customer Sample:	HM-MS-ATV-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	P Henrsen
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~X~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F5	J6	MD11	35 ~~34~~		25.0	10.0					
		MB	11/28/12 DM	39	15.0	0.6	CD	CH			
		B	36 ~~35~~	40	9.5	1.5	CD	CH			
	I8	MD22	37 ~~36~~		45.0	32.0					
		MF		41	8.5	1.3	ADX	AC	42		
		MB	11/28/12 DM	42	17.5	1.4	CD	CH	41		
		MD11	38 ~~37~~		12.0	1.0					
		MB	11/28/12 DM	43	5.4	1.0	CD	CH			
		B	39 ~~38~~	44	5.5	0.4	CD	CH			
	H10	MD11	40 ~~39~~		25.5	7.5					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0012	Volume (L):	704	Scope:	04-03
Customer Sample:	HM-MS-ATV-04	Prepped By:	PK	GO area (mm2):	~~.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	P Petersen
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)	none	3:1	5:1
GO Required:	11				
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~X~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Comments:* Fiber contains elevated levels of Na & K

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F5	1+10	MB		45	14.8	1.5	CD	CH			
	↓	F	41 ~~44~~ ~~40~~ 11/28/12 DM	46	6.0	0.5	ADX	~~AC~~ NRA 11/28/12 DM	*		
	E9	B	11/28/12 DM 0	0	8.0	2.0	~~CD~~ 11/28/12 DM	~~CH~~			
		B	42 ~~41~~	47	26.5	1.5	CD	CH			
		MD11	43 ~~42~~		8.0	2.5					
		MF	11/28/12 DM	48	5.5	0.4	ADX	AC			
		MD11	44 ~~43~~		6.5	2.5					
		MB	11/28/12 DM	49	5.7	0.8	CD	CH			
		F	45 ~~44~~	50	5.4	1.5	ADX	NRA ~~AC~~ 11/28/12 DM	*		
↓	↓	B	46 ~~45~~ 11/28/12 DM	51	9.9	0.8	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0012	Volume (L):	704	Scope:	04-03
Customer Sample:	HM-MS-ATV-04	Prepped By:	PK	GO area (mm2):	~~0.0152~~ 0.0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	P Henrsen
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments: * Fiber contains elevated level of Na & K

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F5	E9	B	47~~46~~	52	11.5	2.5	CD	CH			
		MD11	48~~47~~		17.5	15.0					
		MB	11/28/12 DM	53	5.5	0.8	CD	CH			
		F	49~~48~~	54	5.8	1.3	ADX	~~AC~~ NRA 11/28/12 DM	*		
	B5	MD11	50~~49~~		12.5	6.0					
		MB	11/28/12 DM	55	6.0	1.0	CD	CH			
		MD11	51~~50~~		35.0	15.0					
		MB	11/28/12 DM	56	23.0	0.8	CD	CH			
		MD11	52~~51~~		20.0	10.0					
		MF		57	9.0	0.4	ADX	AC			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0012**	Volume (L):	704	Scope:	04-03
Customer Sample:	HM-MS-ATV-04	Prepped By:	PK	GO area (mm2):	~~.0132~~ .0129 11/28/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	P Henrsen
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)	none	3:1	5:1
GO Required:	11				
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F5	B5	MDII	~~53~~ 52	~~76~~ 58	9.0	4.0					
V	V	MB	11/28/12 DM		6.0	1.4	~~CH~~ CD PK 11/2/12	CH			

Energy Dispersive X-Ray Analysis Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

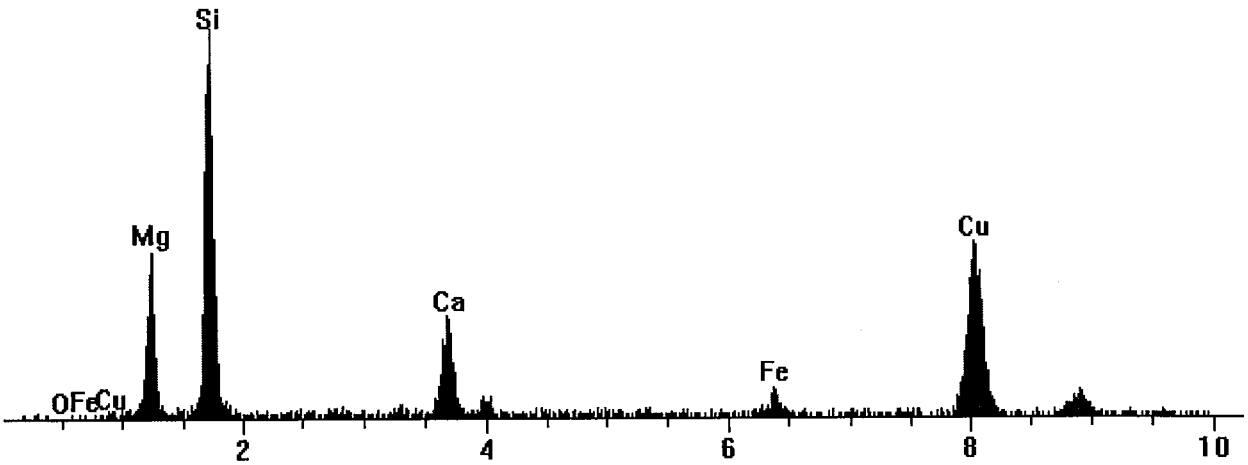
11/28/12 DM

File: L:\EDS Spe...Spectra\Scope 04-03\2012\091211943-0012 ~~K~~F4 J7 2 AC.pgt
Collected: October 31, 2012 08:41:41

Live Time:	34.72	Count Rate:	579	Dead Time:	11.16 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	27032.92				

■ 091211943-0012 ~~K~~F4 J7 2 AC.pgt

FS: 400



Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.7200	17.62	16.35	23.5	MgO	29.22
Si	KA1	1.740	1.0000	32.48	26.09	37.6	SiO	50.98
Ca	KA1	3.691	1.1400	10.83	6.10	8.8	CaO	15.15
Cu	KA1	8.046	0.0000	0.00	0.00	0.0		
Fe	KA1	6.403	1.5300	3.61	1.46	2.1	FeO	4.65
O	KA1	0.523	0.0000	35.45	50.00	72.0		
Total			**0.0000**	**100.00**	**100.00**	**144.0**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	45.0	3.1	41.9
Si	KA1	136.7	3.8	132.8
Ca	KA1	41.8	2.9	38.8
Cu	KA1	105.2	3.7	101.6
Fe	KA1	11.5	1.8	9.7
O	KA1	0.9	0.5	0.3

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

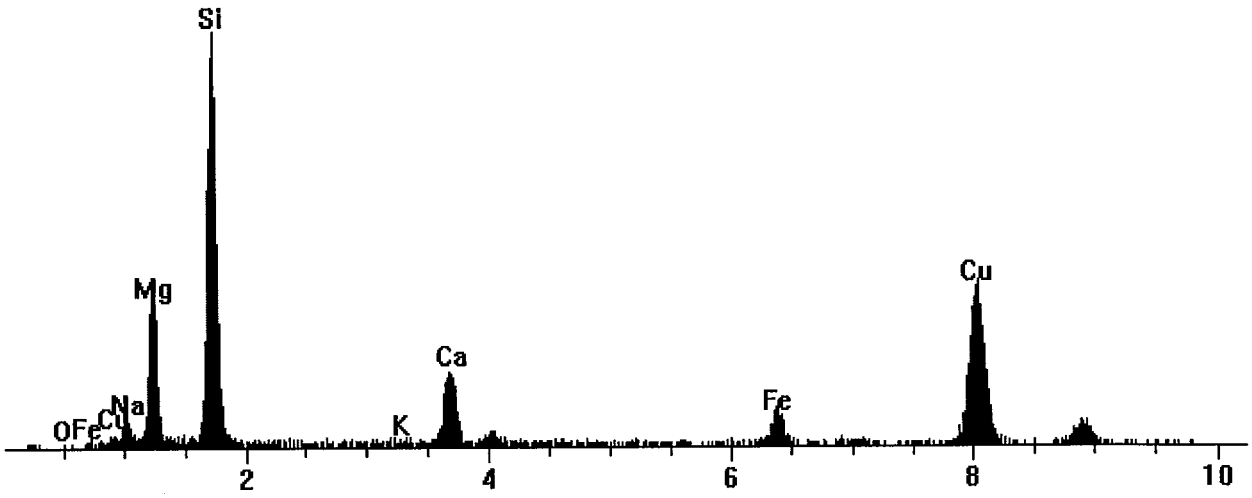
EMSL ANALYTICAL, INC.

File: L:\EDS Spe...pectra\Scope 04-03\2012\091211943-0012 F4 E6 21 AC.pgt
Collected: November 01, 2012 08:00:11

Live Time:	117.68	Count Rate:	239	Dead Time:	4.70 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	28895.99				

091211943-0012 F4 E6 21 AC.pgt

FS: 540



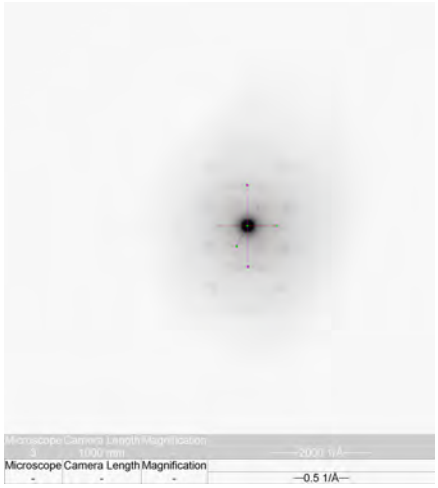
Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.7200	17.95	16.60	24.4	MgO	29.76
Si	KA1	1.740	1.0000	29.66	23.75	34.9	SiO	46.56
K	KA1	3.313	1.2100	0.22	0.12	0.2	K2O	0.26
Ca	KA1	3.691	1.1400	8.02	4.50	6.6	CaO	11.23
Fe	KA1	6.403	1.5300	5.35	2.15	3.2	FeO	6.88
Cu	KA1	8.046	0.0000	0.00	0.00	0.0		
Na	KA1	1.041	2.8100	3.94	3.86	5.7	Na2O	5.31
O	KA1	0.523	0.0000	34.86	49.01	72.0		
Total			**0.0000**	**100.00**	**100.00**	**146.9**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	21.5	1.4	20.1
Si	KA1	58.5	1.5	57.0
K	KA1	1.4	1.1	0.3
Ca	KA1	14.6	1.1	13.5
Fe	KA1	7.5	0.8	6.7
Cu	KA1	40.2	0.9	39.3
Na	KA1	3.9	1.2	2.7
O	KA1	0.6	0.4	0.2

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number:	091211943	**Date:**	Nov 29, 2012
Image Number:	03509		
Reference / Sample Number:	0012		
Preliminary ID:	Chrysotile		
Camera Constant:	1.9179128	**1/A Pixels**	
Calibration Reference:	112612-04-03-03562_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.431**	5.3	**5.06**	**5.56**
Vector Angle:	**58.2**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.502**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.748**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

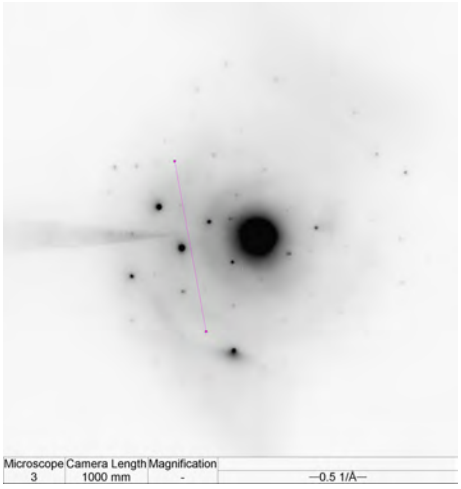
Preliminary Identification was:

X	CORRECT
	INCORRECT

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number:	091211943	**Date:**	Oct 31, 2012
Image Number:	03510		
Reference / Sample Number:	0012		
Preliminary ID:	ACTINOLITE		
Camera Constant:	1.949e-003	**1/A Pixels**	
Calibration Reference:	103112-04-03-03508_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.261**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.):	**N/A**	N/A	**-**	**-**
d1 or hkl (Camera K/slant vector dist.):	**N/A**	N/A	**-**	**-**
Ratio of hk0/hkl:	**N/A**	N/A	**-**	**-**
Vector Angle:	**N/A**	N/A	**-**	**-**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: [**N/A**]

Preliminary Identification was:

X	CORRECT
	INCORRECT

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0013**	Volume (L):	723	Scope:	09-C2
Customer Sample:	HM-MS-ATV-05	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	G, 1-3	Analysis Date:	9/20/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	0				OVERLOADED
Level of Analysis Chrysotile:	CDQ 11/20/12	Min Length:	> 5	micron	18%
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0013**	Volume (L):	723	Scope:	~~0412~~ 04-01 11/28/12 DM
Customer Sample:	HM-MS-ATV-05	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012 11/28/12 DM	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121001~~ 0412-ERRG-01	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~G, 1-3~~ A (1-3)	Analysis Date:	10/27/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	11	none	3:1	5:1	15% PART. LOADING
GO Analyzed:	11				VERT. TRAVERSE
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
A1	C9	F	0	0	5	.7	ADX	NRA/ACT	ACT NaK	011311	1
		MD21	0		11.2	3.5					
		MF		0	11.2	.75	ADX	NRA		011313	
		MF		0	4.1	.25	ADX	NRA	ACT NaK		
		MD11	1		7	2.2					
		MF		1	7	.7	ADX	NRA	ACT NaK		
		MD11	2		10.2	2.7					
		MF		2	10.2	.25	ADX	TREM	← pcsolite	011315	1
		MD11	3		6.5	4.6					
		MF		3	6.5	.75	ADX	TREM		011317	

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0013**	Volume (L):	723	Scope:	04-01
Customer Sample:	HM-MS-ATV-05	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412- ~~121001~~ ERRG-01 11/28/12 DM	Analyzed By:	F. Craig
EFA (mm^2):	385	Grid Location:	~~G, 1-3~~ A (1-3)	Analysis Date:	10/27/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
A1	C9	F	0	0	10.6	1	ADX	NRA	Nak ACT		
		MC11	4	4	14	3.6	ADX	TREM			
		MD11	5		Fc 10/27/12 ~~14.7~~ 29.4	2.5					
		MB		5	~~14.7~~ 29.4	1.3	CD	CH		011319	
	B7/6	B	6	6	9.5	1.5	CD	CH			1
		MD11	~~6~~ 7		6.7	1.5					
		MF		7	6.7	.4	ADX	NRA	ACT NaK		
		MD11	8		18	12					
		MF		8	18	.3	ADX	NRA	ACT NaX		

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0013**	Volume (L):	723	Scope:	04-01
Customer Sample:	HM-MS-ATV-05	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412-~~121001~~ ERGr-01 11/28/12 DM	Analyzed By:	F. Craig
EFA (mm^2):	385	Grid Location:	~~G, 1-3~~ A (1-3)	Analysis Date:	10/27/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A1	B~~7~~6	MD11	9		7.5	2.8			ACT NoX		
		MF		9	7.5	.8	ADX	NRA			
		MD11	10		9	4.5					
		MF		10	9	.6	ADX	TREM			
	D7	MD11	11		7.7	2.5					
		MF		11	7.6	.9	ADX	TREM			
		B	12	12	8	.75	CD	CH			
		MD11	13		35.4	5					
		MB		13	30.7	2.5	CD	CH			
	E5	F	14	14	5.8	.6	ADX	NRA	ACT NoX		

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0013**	Volume (L):	723	Scope:	04-01
Customer Sample:	HM-MS-ATV-05	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412-~~121001~~ ERRG-01 11/28/12 DM	Analyzed By:	E. Craig
EFA (mm^2):	385	Grid Location:	~~G, 1-3~~ A (1-3)	Analysis Date:	10/27/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A1	E5	MD	15		5.7	3.5					
		MF		15	5.2	.25	CD	CH			
		MD11	16		7	6.2					
		MF		16	6.2	.4	ADX	TREM			
		MD11	17		7.2	2.2					
		MF		17	7.2	.3	ADX	TREM			
		MC11	18	18	12.5	10	ADX	TREM			
	E9	MD11	19		18.8	4.5					
		MB		19	18.8	1	ADX	WRA	ACT NaK		

ISO 10312

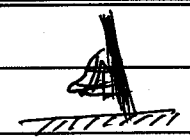
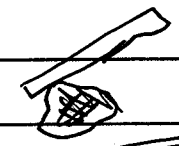
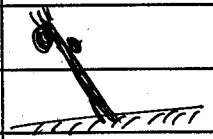
TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0013**	Volume (L):	723	Scope:	04-01
Customer Sample:	HM-MS-ATV-05	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412- ~~121001~~ ERRG-01	Analyzed By:	F. Craig
EFA (mm^2):	385	Grid Location:	~~G 1-3~~ A(1-3)	Analysis Date:	10/27/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A1	E9	MD11	20		12	1.5					
		MB		20	12	.5	CD	CH			
		MD11	21		8.5	3.6					
		MF		21	6.4	.75	ADX	NRA			
	G10	F	22	22	12.8	1	ADX	TREM			
A2	F7	MD11	23		24.8	1.5					
		MB		23	24.8	.5	CD	CH			
		MD11	24		8.3	5.5					
		MB		24	8.3	.25	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0013**	Volume (L):	723	Scope:	04-01
Customer Sample:	HM-MS-ATV-05	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412 - ~~121001~~ ERRG-01 11/28/12 DM	Analyzed By:	F. Craig
EFA (mm^2):	385	Grid Location:	~~G, 1-3~~ A(1-3)	Analysis Date:	10/27/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
A2	G9	MD11	25		11.3	6					
		MF		25	11.3	.6	ADX	TREM			
	F6	F	26	26	5.5	.75	ADX	NRA	ACT NRA		
		MD11	27		29	7.5					
		MF		27	29	1.8	ADX	TREM			
		MD11	28		7.5	2					
		MF		28	7.5	.75	ADX	TREM			
		MD11	29		15.5	2.8					
		MB		29	15.5	1	CD	CH			
	D6	B	30	30	10	1.2	CD	CH			

ISO 10312

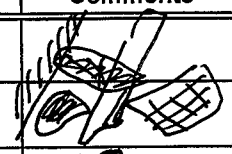
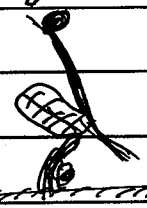
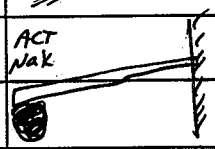
TEM Asbestos Count Sheet

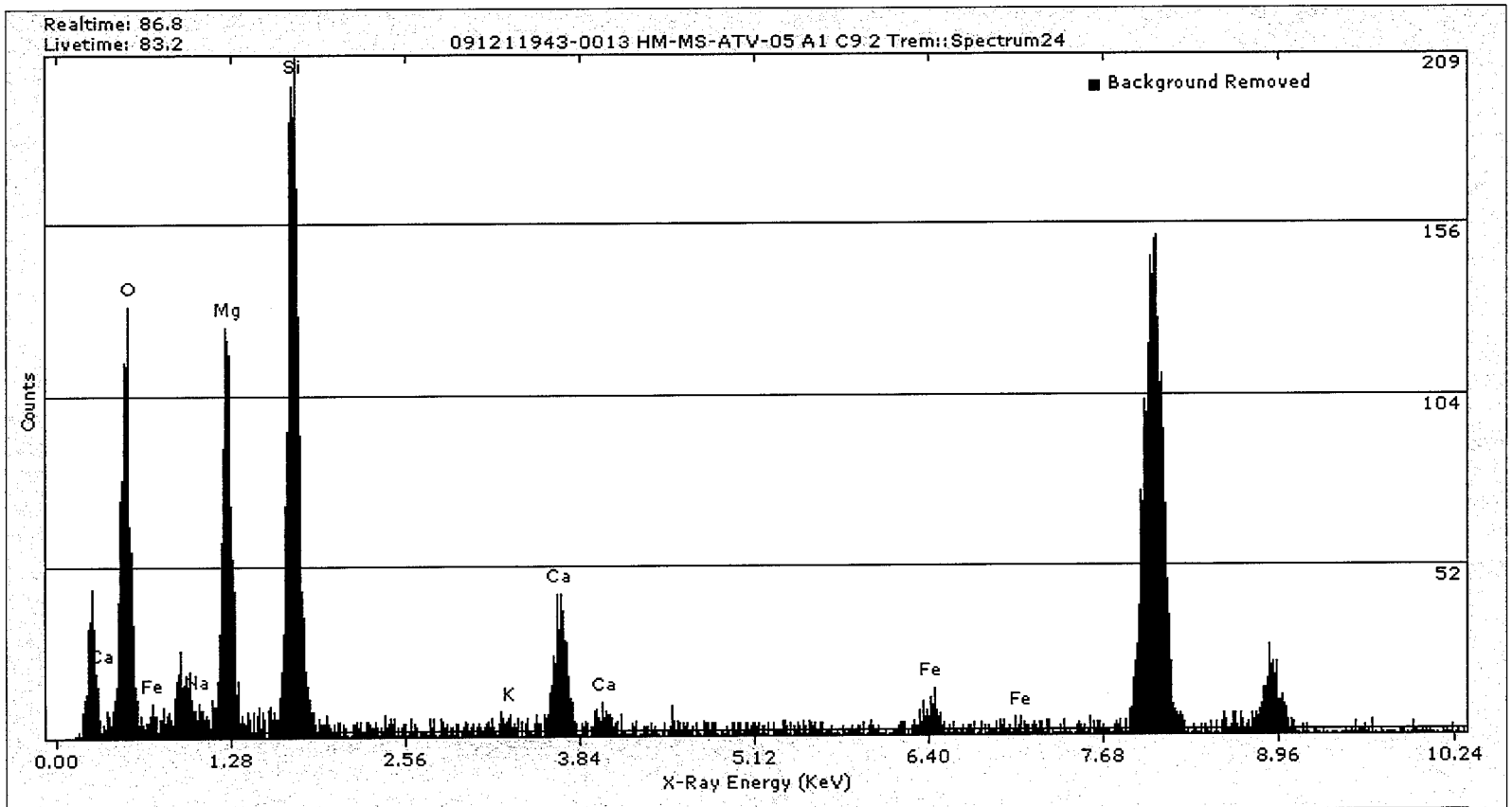
EMSL Sample ID:	**091211943-0013**	Volume (L):	723	Scope:	04-01
Customer Sample:	HM-MS-ATV-05	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412- ~~121001~~ ERRG-01 11/28/12 DM	Analyzed By:	F. Craig
EFA (mm^2):	385	Grid Location:	~~G, 1-3~~ A(1-3)	Analysis Date:	10/27/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

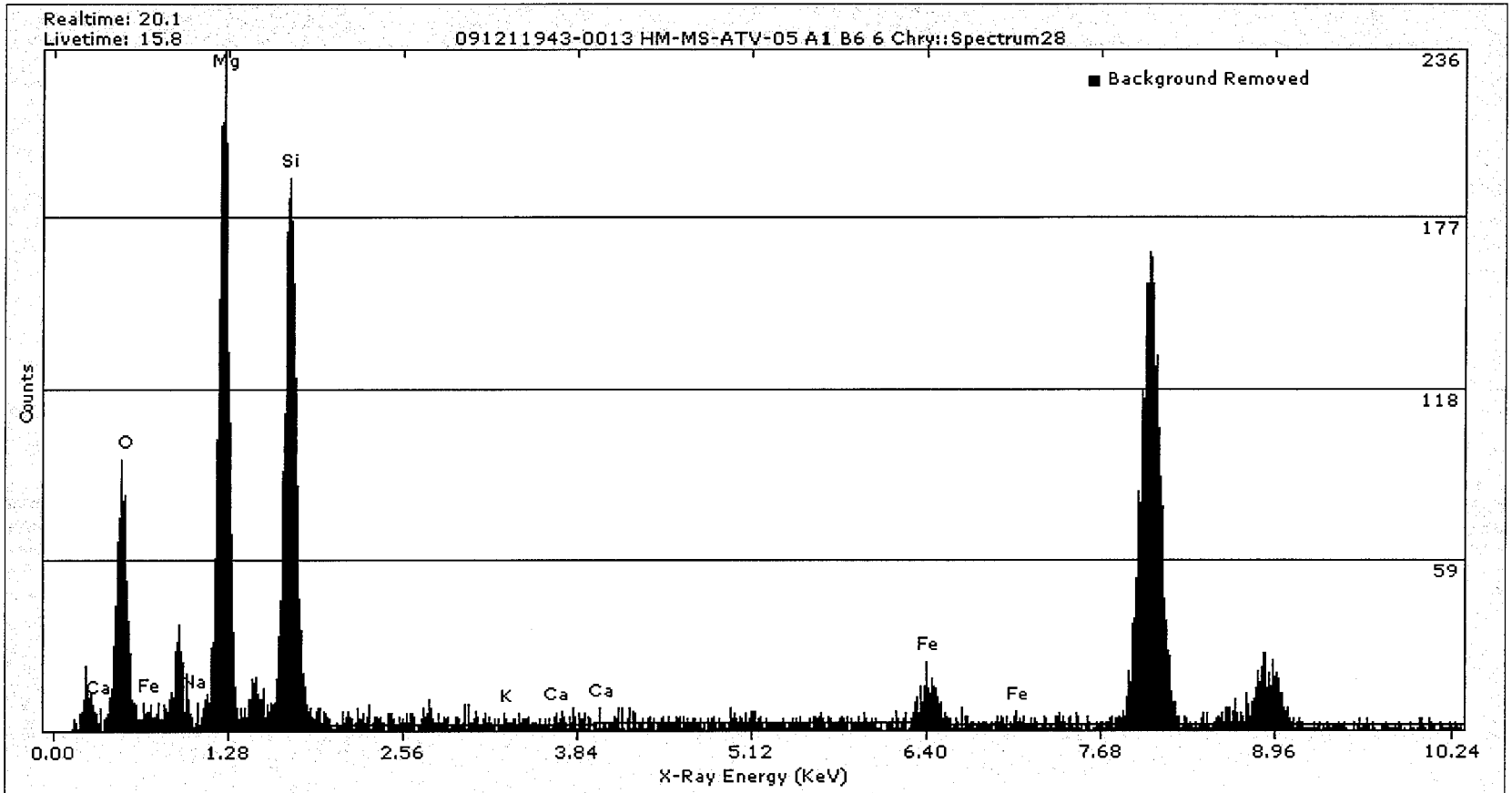
Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
A2	B7	MD11	31		67.5	6					
		MF		31	6	.7	ADX	NRA			
		MD22	32		108	14					
		MB		32	56	3.5	CD	CH			
		MB		33	30	.75	CD	CH			
		MD11	33		6	2.2					
		MB		34	5.9	.5	CD	CH			
		MD11	34		24	3.6			ACT Nak 		
		MF		35	24	.6	ADX	NRA			



Quantitative Results for Spectrum24
Analysis: Thin Film Method: Standardless
Acquired 27-Oct-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	47.01	1.77	60.71	0.00		0.0000	0.0	85.8	872.70
Sodium	0.86	0.02	0.77	1.16	(Na2O)	0.0134	30.3	92.8	73.94
Magnesium	15.64	0.40	13.29	25.93	(MgO)	0.1992	694.5	95.6	796.92
Silicon	29.75	0.76	21.88	63.65	(SiO2)	0.3579	1540.9	101.4	1651.13
Potassium	0.33	0.01	0.17	0.40	(K2O)	0.0042	17.5	118.4	34.25
Calcium	5.49	0.14	2.83	7.68	(CaO)	0.0426	295.8	122.2	359.07
Iron	0.92	0.02	0.34	1.18	(FeO)	0.0086	39.4	146.3	87.14
Total	100.00			100.00					



Quantitative Results for Spectrum28
Analysis: Thin Film Method: Standardless
Acquired 27-Oct-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	45.83	1.97	58.30	0.00		0.0000	0.0	85.7	652.22
Sodium	0.00	0.00	0.00	0.01	(Na2O)	0.0000	0.2	92.8	40.32
Magnesium	28.96	0.72	24.25	48.02	(MgO)	0.4146	1616.6	95.5	1652.15
Silicon	22.92	0.59	16.61	49.03	(SiO2)	0.3099	1491.7	101.4	1559.81
Potassium	0.00	0.00	0.00	0.00	(K2O)	0.0000	0.2	118.4	7.07
Calcium	0.01	0.00	0.01	0.02	(CaO)	0.0000	1.0	122.1	12.87
Iron	2.27	0.06	0.83	2.92	(FeO)	0.0186	122.1	146.2	181.94
Total	100.00			100.00					

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Oct 27, 2012

Image Number: 011315

Sample Number: 0013-04-01

Preliminary ID: Tremolite

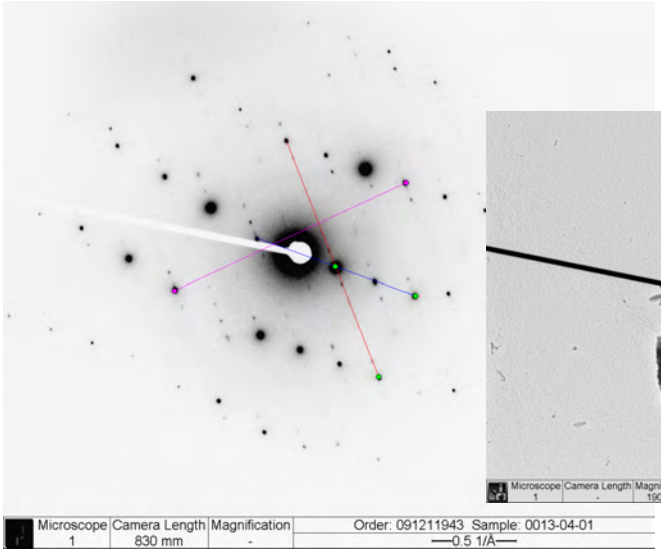
Camera Constant: 2.964e-003 **1/A Pixels**

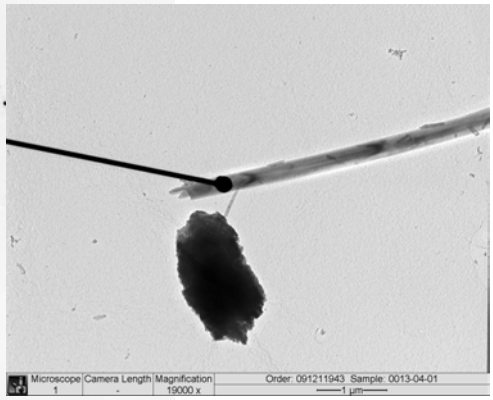
Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.303**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**1.336**	0.000	**0.000**	**0.000**
d1 or hkl (Camera K/slant vector dist.):	**3.990**	0.000	**0.000**	**0.000**
Ratio of hk0/hkl:	**0.167**	0.000	**0.000**	**0.000**
Vector Angle:	**48.7**	0.000	**0.000**	**0.000**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **TREMOLITE**

With a Zone Axis of: [**N/A**]





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By:

F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Oct 27, 2012

Image Number: 011317

Sample Number: 0013-04-01

Preliminary ID: Tremolite

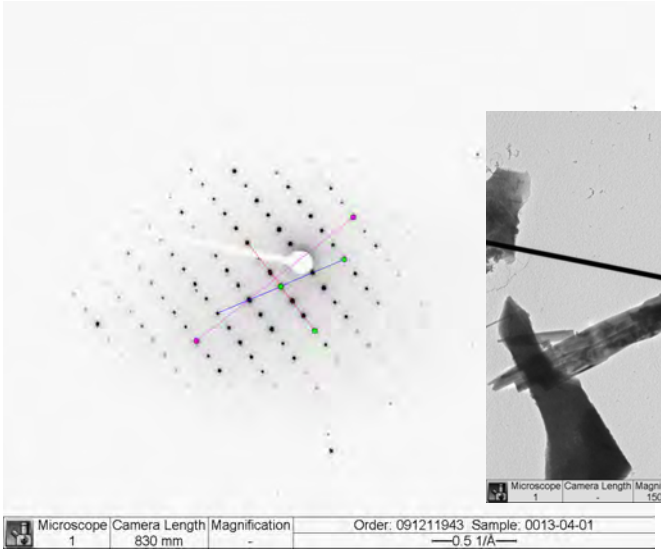
Camera Constant: 2.964e-003 **1/A Pixels**

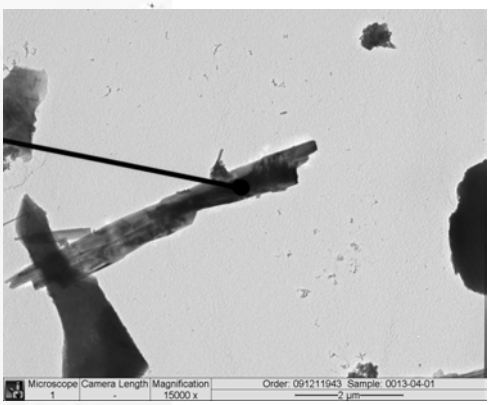
Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.112**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**4.747**	4.753	**4.515**	**4.991**
d1 or hkl (Camera K/slant vector dist.):	**5.102**	5.092	**4.837**	**5.347**
Ratio of hk0/hkl:	**0.930**	0.933	**0.886**	**0.980**
Vector Angle:	**75.3**	75.300	**71.535**	**79.065**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **TREMOLITE**

With a Zone Axis of: [**0 -1 0**]





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By:

F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Oct 27, 2012

Image Number: 011319

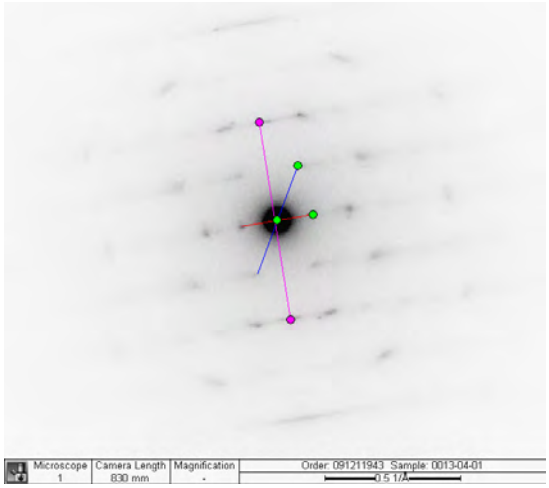
Reference / Sample Number: 0013

Preliminary ID: Chrysotile

Camera Constant: 2.9643032 **1/A Pixels**

Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.418**	5.3	**5.06**	**5.56**
Vector Angle:	**60.1**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.35**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.687**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0014**	Volume (L):	544	Scope:	09-02
Customer Sample:	HM-MS-MB-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	G, 4-6	Analysis Date:	9/20/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	14	none	3:1	5:1	
GO Analyzed:	14				
Level of Analysis Chrysotile:	CD~~Ø~~ 11b6/n 4um	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
G4	D1	ND									
G4	D3	B	1	1	11.3	2.5	CD	CHRYS		44014	YES
G4	D6	ND									
G4	D8	ND									
G4	D10	ND									
G5	B10	ND									
G5	B8	ND									
G5	B6	ND									
G5	B4	ND									
G5	B2	ND									
G6	B2	ND									
G6	B4	ND									
G6	B6	B	2	2	9.95	2	CD	CHRYS			
G6	B6	B	3	3	22.8	2.7	CD	CHRYS			
G6	B8	ND									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 091211943-0014 **Client:**

Client Sample:

Page 1 of 1

Primary Structure # 1	Primary Structure # 2	Primary Structure # 3	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Structure #	Structure #	Structure #	Structure #

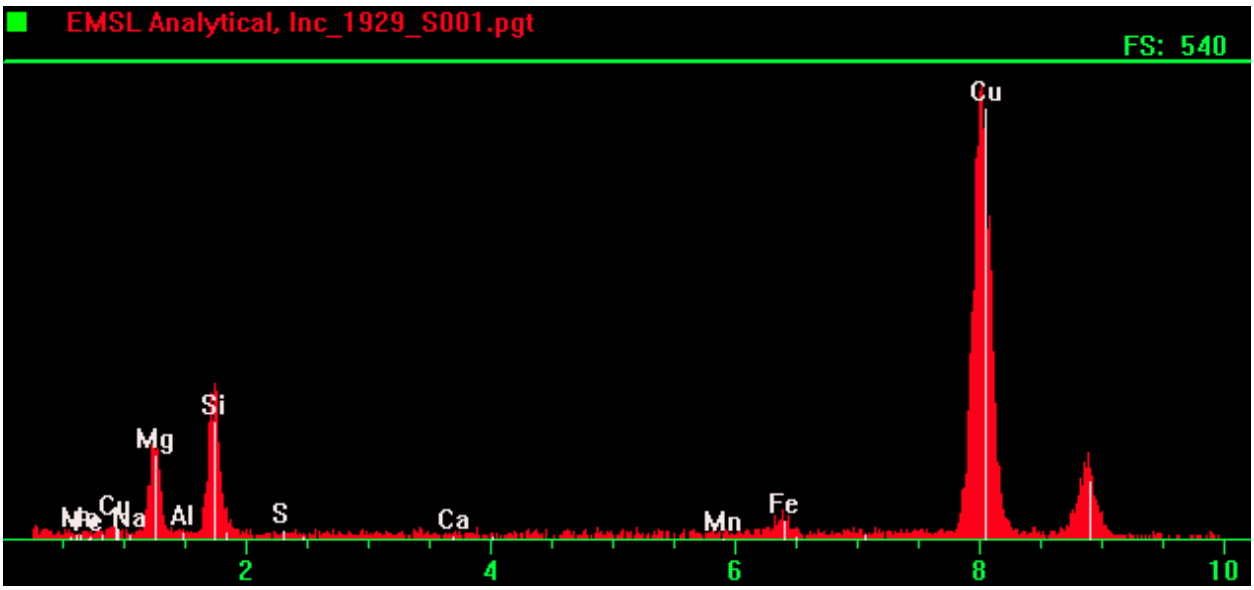
Analyst: KD Date: 20SEP12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0014_TEM_ISO_10312_EDX_Chrysotile
Collected: September 20, 2012 12:50:38

Live Time:	29.00	Count Rate:	1294	Dead Time:	16.59 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	4.5	5.7	0.0	0.0
Mg	KA1	67.5	5.8	61.7	10.7
Al	KA1	8.8	6.0	2.8	0.5
Si	KA1	109.2	5.4	103.7	19.2
S	KA1	5.3	4.7	0.6	0.1
Ca	KA1	5.7	4.3	1.5	0.3
Mn	KA1	7.1	5.0	2.0	0.4
Fe	KA1	22.9	5.4	17.3	3.2
Cu	KA1	516.8	6.9	509.9	73.9

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/20/12

Indexing of negative number: 44014 SCOPE #: 2

Reference / Sample Number: 14

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.54 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.25	mm

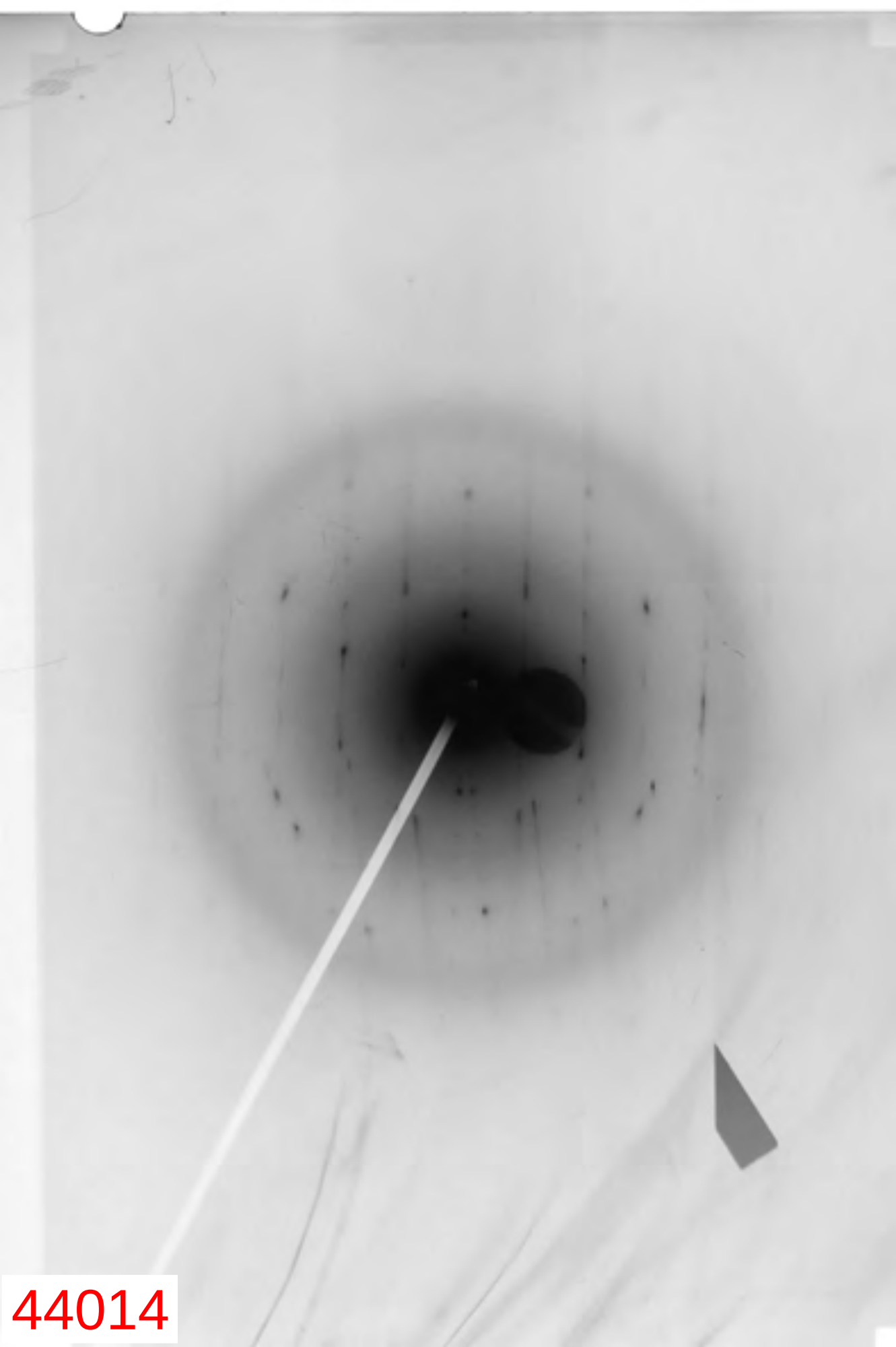
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.27**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.56**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



44014

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0015	Volume (L):	580	Scope:	09-02
Customer Sample:	HM-MS-MB-~~03~~ 02 11/20/12 DJM	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	H, 1-3	Analysis Date:	9/20/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	13	none	3:1	5:1	
GO Analyzed:	13				
Level of Analysis Chrysotile:	~~CDQ~~ 11/20/12 DJM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
H1	G2	ND									
H1	G4	ND									
H1	G6	ND									
H1	G8	ND									
H1	G10	ND									
H2	F7	ND									
H2	F5	ND									
H2	F3	B	1	1	39.6	1.8	CDQ	CHRYS		44015	YES
H2	F1	ND									
H3	B8	B	2	2	9.1	1.3	CD	CHRYS			
H3	B6	B	3	3	18.2	3.8	CD	CHRYS			
H3	B4	ND									
H3	B2	ND									

ND= None Detected

NAM= Non Asbestos Material

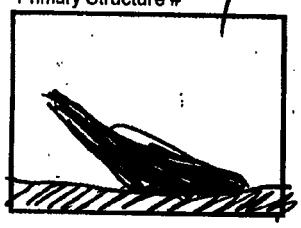
TEM ISO 10312

Structure Sketch Sheet

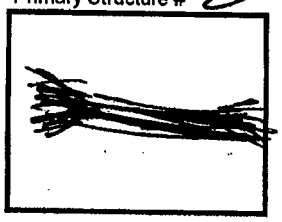
EMSL Order ID: 0912141943-0015 **Client:**

Client Sample: _____ Page 1 of 1

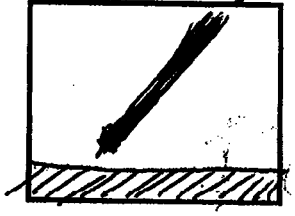
Primary Structure # 1



Primary Structure # 2



Primary Structure # 3



Primary Structure #

Primary Structure #

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Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

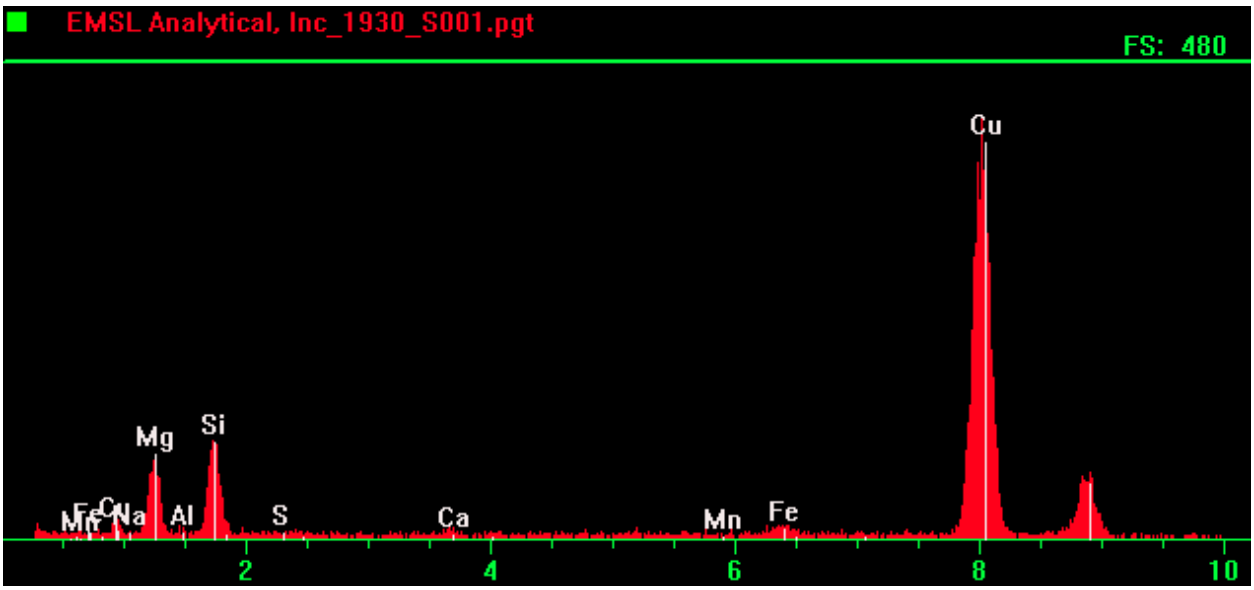
Analyst: KD Date: 20 SEPT 12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0015_TEM_ISO_10312_EDX_Chrysotile
Collected: September 20, 2012 15:16:16

Live Time:	35.03	Count Rate:	791	Dead Time:	10.29 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.5	3.3	0.0	0.0
Mg	KA1	42.6	3.4	39.2	11.4
Al	KA1	4.4	3.6	0.7	0.2
Si	KA1	55.2	2.9	52.4	18.3
S	KA1	4.0	3.2	0.8	0.3
Ca	KA1	6.0	2.7	3.3	1.2
Mn	KA1	3.4	3.1	0.4	0.1
Fe	KA1	10.7	3.2	7.5	2.4
Cu	KA1	331.2	4.6	326.6	71.5

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/20/12

Indexing of negative number: 44015 SCOPE #: 2

Reference / Sample Number: 15

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

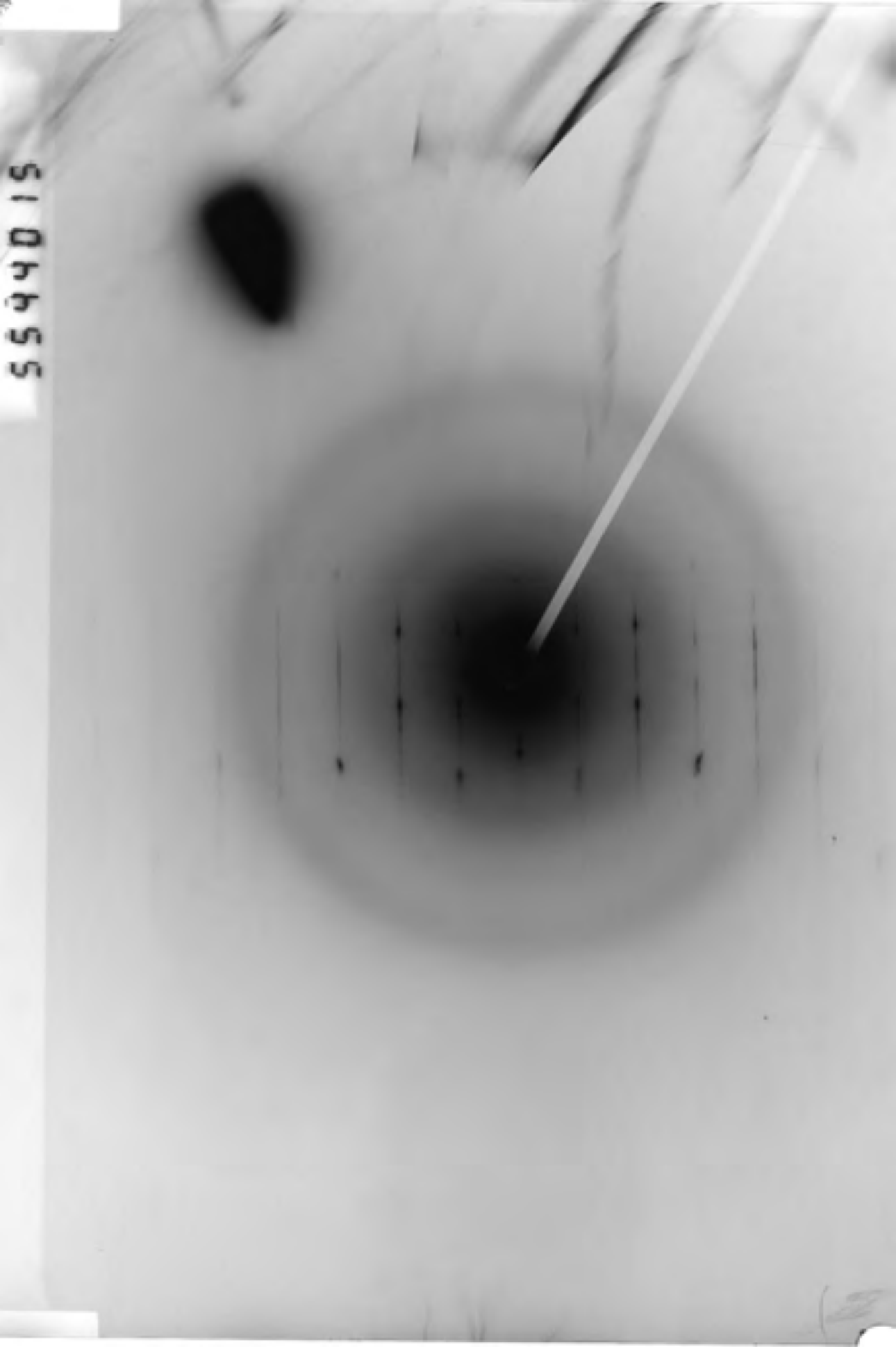
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	63	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____


55440 15

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0016	Volume (L):	688	Scope:	09-02
Customer Sample:	HM-MS-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	H, 4-6	Analysis Date:	9/20/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CDQ 11/26/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
H4	I10	B	1	1	5.1	1.3	CD	CHRYS		45895	11/26/12 DM
H4	I10	B	2	2	5.2	0.55	CD	CHRYS			
H4	I8	B	3	3	5.2	1.3	CD	CHRYS			
H4	I8	B	4	4	12.6	3.2	CD	CHRYS			
H4	I6	B	5	5	8.2	1.5	CD	CHRYS			
H4	I4	B	6	6	15.5	2.3	CD	CHRYS			
H4	I2	B	7	7	23.5	3.1	CDQ	CHRYS			YES
H4	I2	B	8	8	9.8	2.3	CD	CHRYS			
H4	H1	B	9	9	21.3	2.2	CD	CHRYS			
H4	H1	B	10	10	16.4	5	CD	CHRYS			
H4	G10	B	11	11	31.2	3.1	CD	CHRYS			
H5	G9	None Detected									
H5	G7	None Detected									
H5	G5	None Detected									
H5	G3	B	12	12	5.6	1.2	CD	CHRYS			
H5	G3	B	13	13	7.1	0.35	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

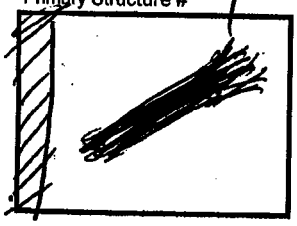
Structure Sketch Sheet

EMSL Order ID: 0912211943-0016 **Client:**

Client Sample:

Page 1 of 1

Primary Structure # 1



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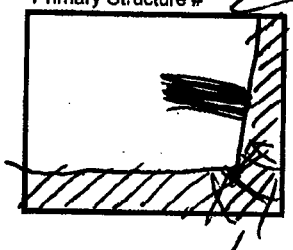

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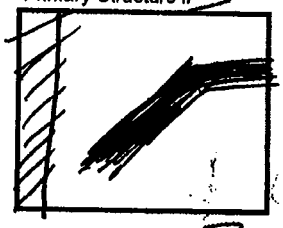

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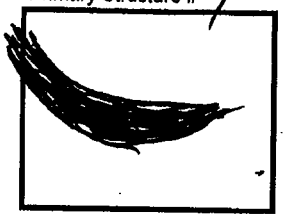

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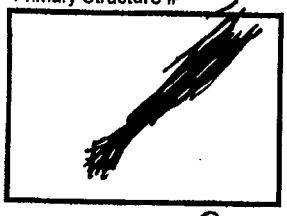

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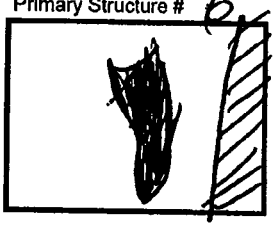
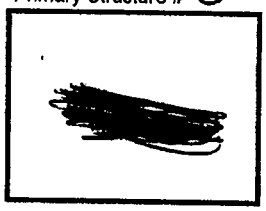


Primary Structure # 7

Primary Structure # 8



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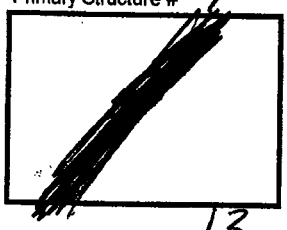

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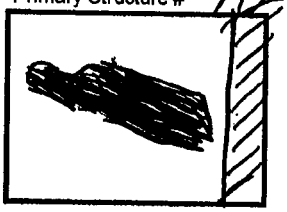

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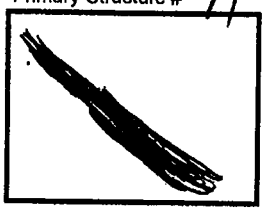
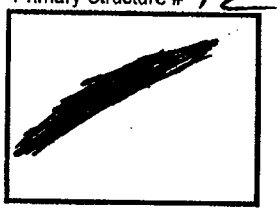


Primary Structure # 12



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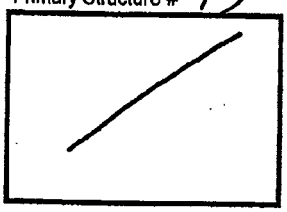


Primary Structure #

Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

Analyst: KD

Date: 20SEPT12

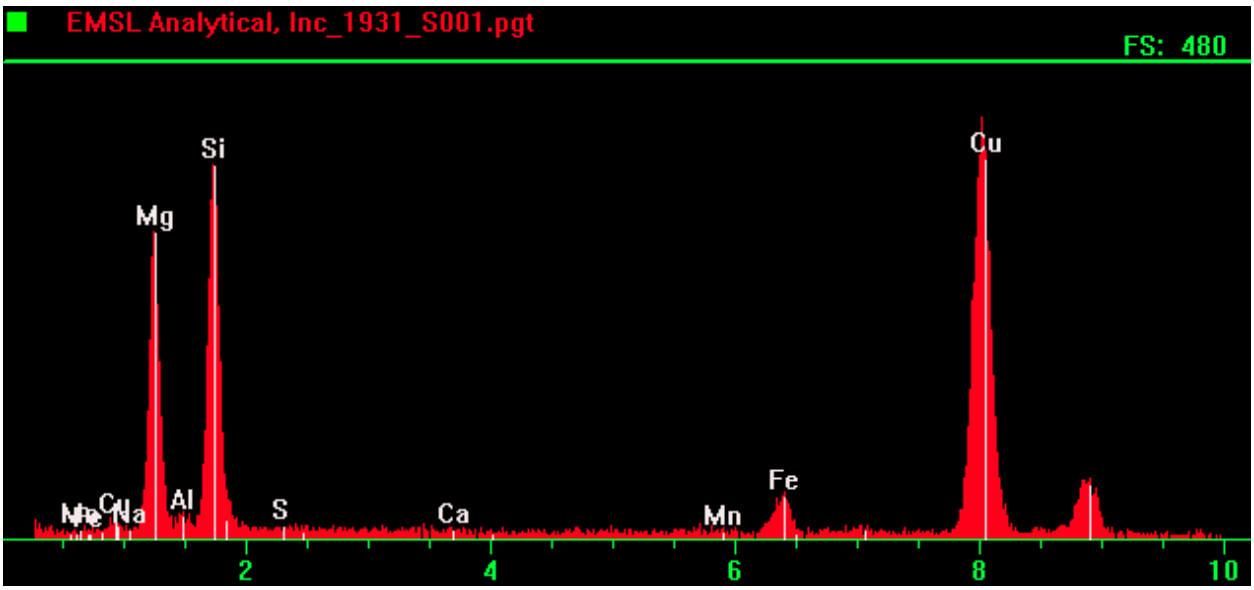
Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0016_TEM_ISO_10312_EDX_Chrysotile
Collected: September 20, 2012 17:33:28

Live Time:	34.97	Count Rate:	1325	Dead Time:	16.06 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	6.0	5.9	0.0	0.0
Mg	KA1	150.7	6.9	143.9	21.0
Al	KA1	15.5	7.9	7.7	1.0
Si	KA1	205.8	7.9	198.0	25.2
S	KA1	7.7	7.0	0.7	0.1
Ca	KA1	6.6	4.4	2.1	0.5
Mn	KA1	5.7	5.1	0.6	0.1
Fe	KA1	34.4	5.3	29.0	5.5
Cu	KA1	348.1	5.7	342.4	59.9

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/02/12

Indexing of negative number: 43895 SCOPE #: 2

Reference / Sample Number: 0016

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.55 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.20	mm

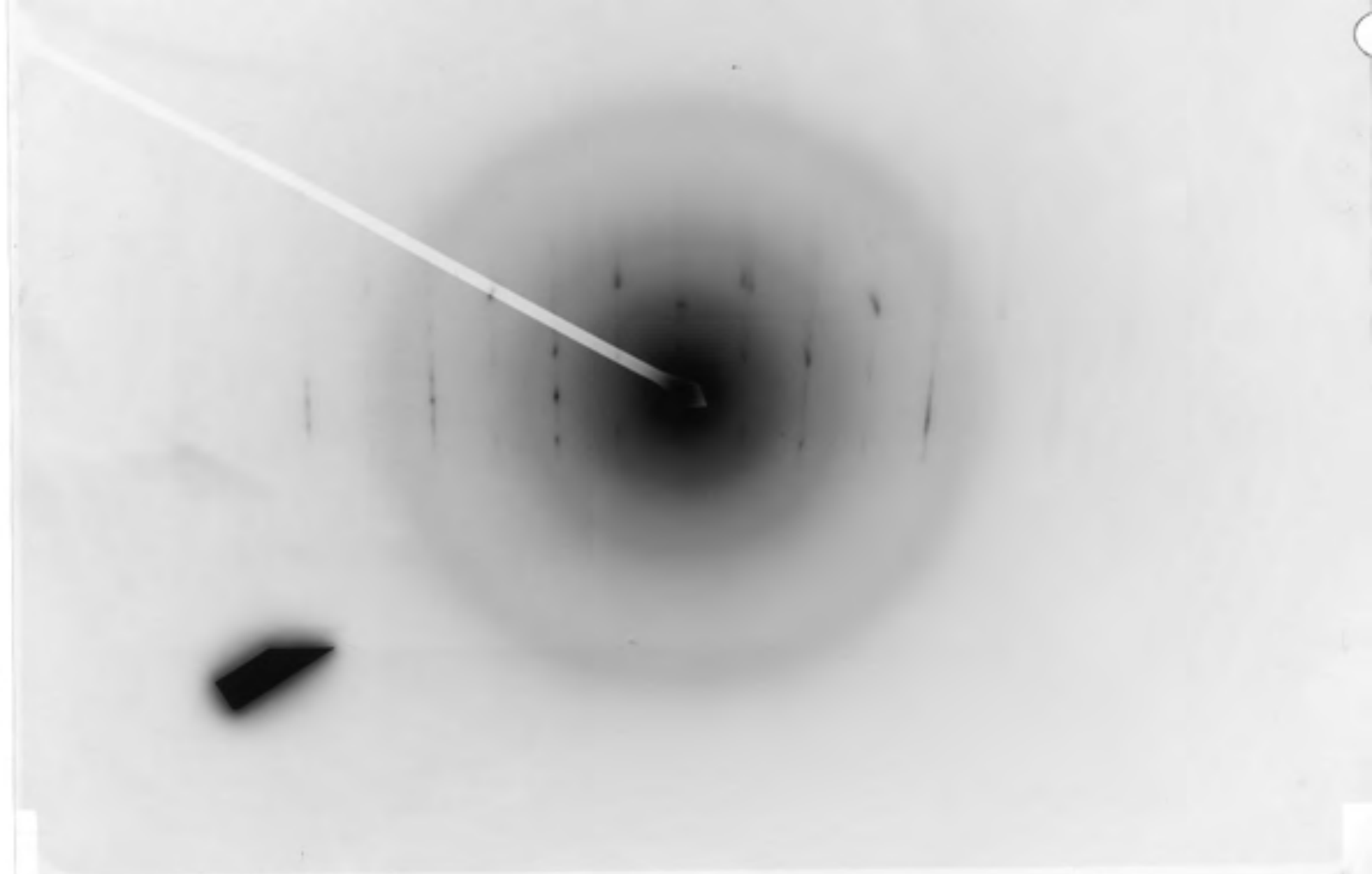
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.26**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	7.32	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.60**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____


5b8Eb86

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0017**	Volume (L):	675	Scope:	09-02
Customer Sample:	HM-MS-MB-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001/12I003	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	I, 1-3/C, 1-6	Analysis Date:	9/22/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	12	none	3:1	5:1	
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Q~~ 11/2u/12	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
I1	F10	B	1	1	9.5	3	CDQ	CHRYS		43896	YES
I1	F10	B	2	2	6.3	1.2	CD	CHRYS			
I1	F8	None Detected									
I1	F6	None Detected									
I1	F4	MD11	3		11.5	12.5	CD	CHRYS			
I1	F4	MB		3	9	0.45	CD	CHRYS			
I1	F4	B	4	4	5	1.3	CD	CHRYS			
I1	F2	B	5	5	6.9	1.4	CD	CHRYS			
I1	F2	B	6	6	10.2	0.9	CD	CHRYS			
I1	F2	B	7	7	10.3	2.1	CD	CHRYS			

ISO 10312

091211943-0017

TEM Asbestos Count Sheet

I1	F2	B	8	8	13.2	2.1	CD	CHRYS			
C1	A2	B	9	9	12.3	2.5	CD	CHRYS			
	A4	MD11	10		5.75	2.6	CD	CHRYS			
		MB		10	5.75	0.28	CD	CHRYS			
		B	11	11	6.6	0.8	CD	CHRYS			
	A6	B	12	12	8.1	0.9	ADX	ACTIN			yes
	A8	B	13	13	10.4	2.4	CD	CHRYS			
		B	14	14	5.8	1.3	CD	CHRYS			
		B	15	15	21.3	2.5	CD	CHRYS			
		B	16	16	8.6	1.2	CD	CHRYS			
C2	C10	B	17	17	6.9	1.6	CD	CHRYS			
		MD11	18		6.6	2.3	CD	CHRYS			
		MB		18	6.6	0.4	CD	CHRYS			
		B	19	19	6.2	1.2	CD	CHRYS			
	C8	B	20	20	10.8	3.5	CD	CHRYS			
		B	21	21	6.8	1.3	CD	CHRYS			
		B	22	22	21.9	3.8	CD	CHRYS			
		B	23	23	7.05	0.8	CD	CHRYS			
	C6	MD11	24		8.8	2.3	CD	CHRYS			
		MB		24	6.8	1.4	CD	CHRYS			
		B	25	25	7.5	1	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

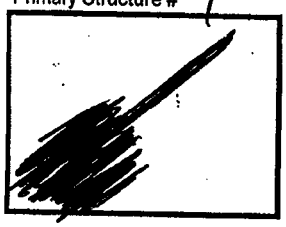
Structure Sketch Sheet

EMSL Order ID: 0912119B-0017 **Client:**

Client Sample:

Page 1 of 2

Primary Structure # 1



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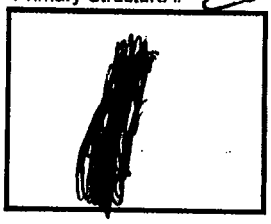

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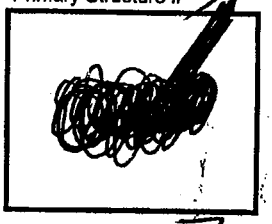

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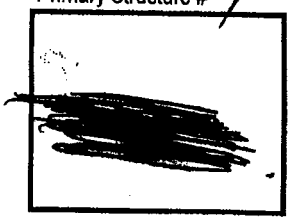

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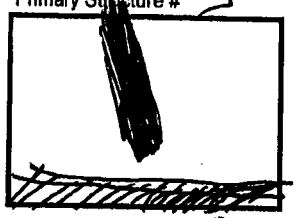

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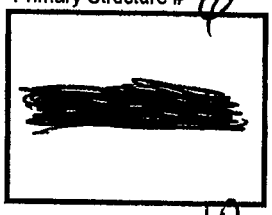

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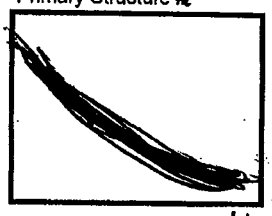

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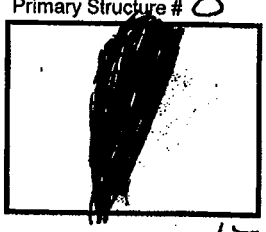

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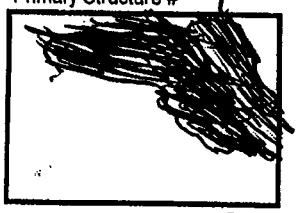

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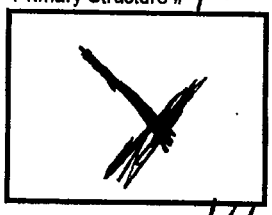

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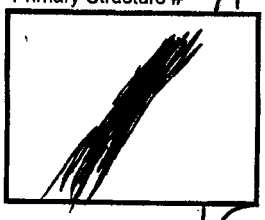

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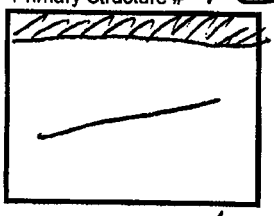

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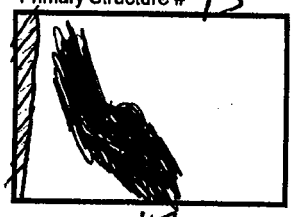

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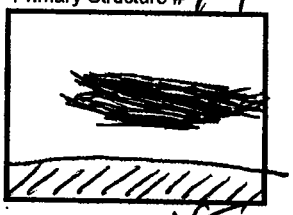

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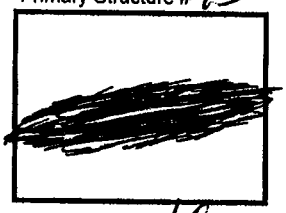

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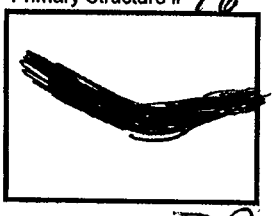

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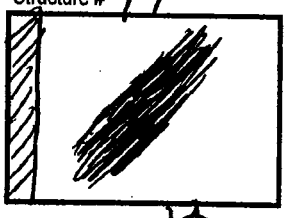

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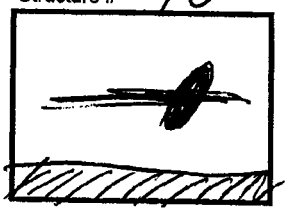

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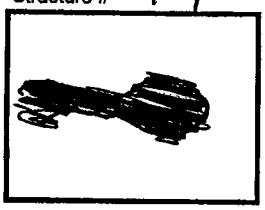


Structure # 20

Analyst: KP

Date: 23SEP12

Scope: Z

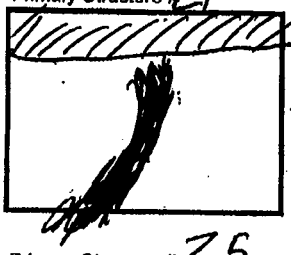
TEM ISO 10312

Structure Sketch Sheet

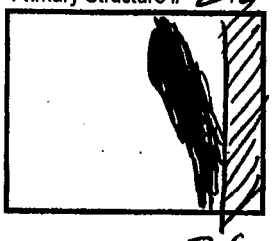
EMSL Order ID: 0912119413-0017 **Client:**

Client Sample: _____ Page 2 of 2

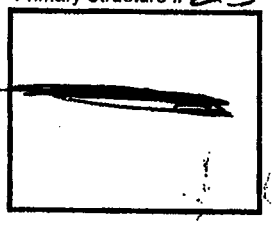
Primary Structure # 21



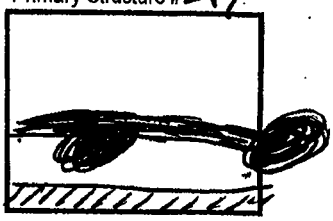
Primary Structure # 22



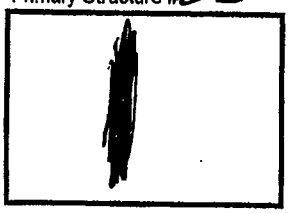
Primary Structure # 23



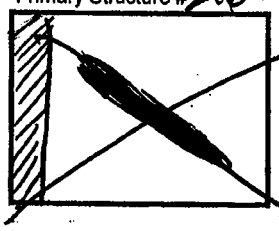
Primary Structure # 24



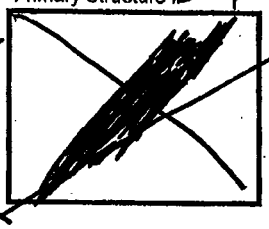
Primary Structure # 25



Primary Structure # 26



Primary Structure # 26



Primary Structure #

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Structure #

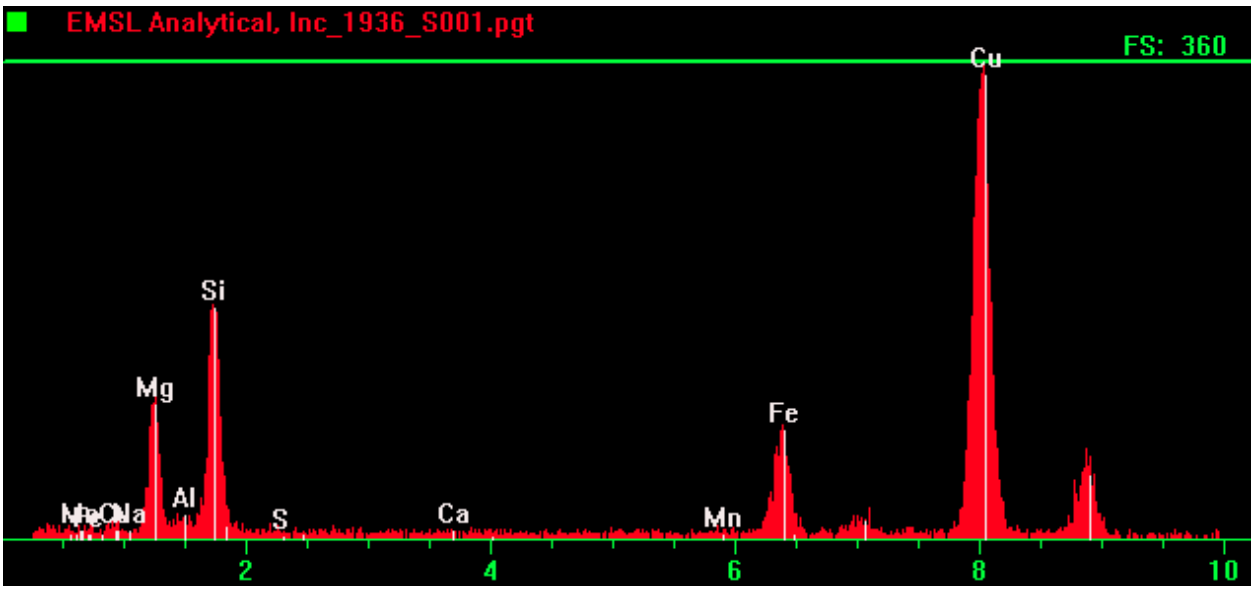
Analyst: KD Date: 17OCT12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0017_TEM_ISO_10312_EDX_Chrysotile
Collected: September 23, 2012 12:54:11

Live Time:	31.91	Count Rate:	998	Dead Time:	12.38 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



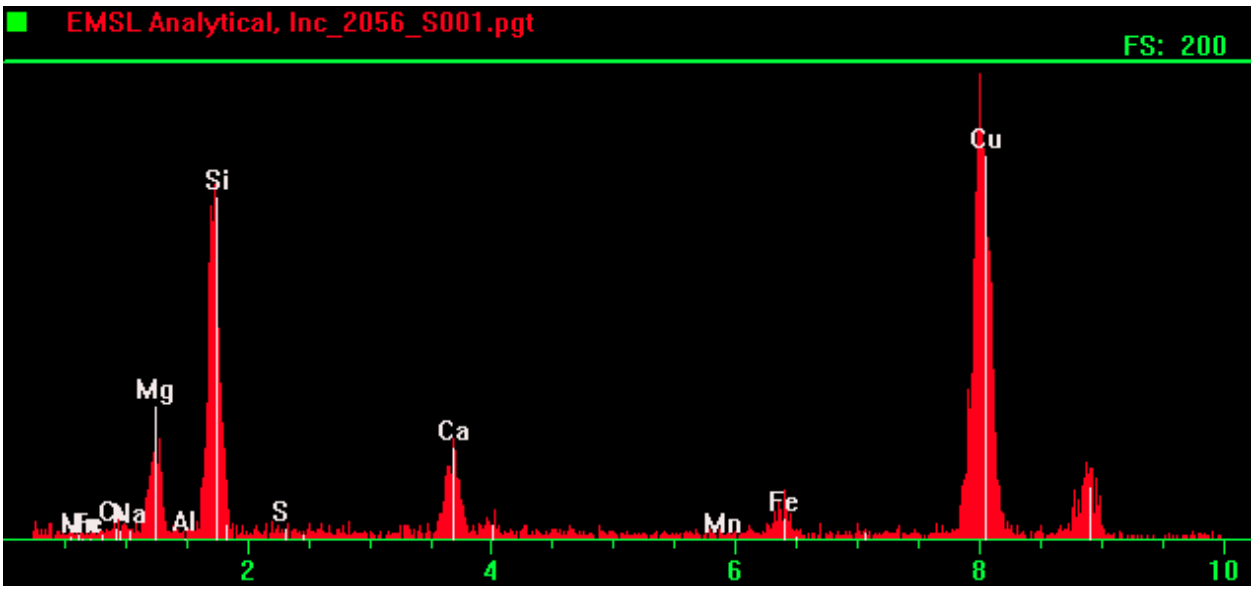
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.7	4.4	0.0	0.0
Mg	KA1	63.7	5.1	58.7	11.6
Al	KA1	12.4	5.3	7.1	1.4
Si	KA1	107.4	4.9	102.5	20.8
S	KA1	4.7	4.3	0.4	0.1
Ca	KA1	5.2	2.9	2.3	0.8
Mn	KA1	5.0	3.4	1.6	0.5
Fe	KA1	68.7	4.5	64.0	14.2
Cu	KA1	319.5	5.0	314.5	62.7

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0017_TEM_ISO_10312_EDX_Actinolite
Collected: October 18, 2012 13:50:18

Live Time:	38.28	Count Rate:	432	Dead Time:	5.71 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	2.6	2.0	0.3	0.1
Mg	KA1	20.3	1.8	18.5	10.2
Al	KA1	2.1	2.0	0.1	0.1
Si	KA1	73.2	2.0	71.2	34.9
S	KA1	2.2	1.4	0.8	0.5
Ca	KA1	23.0	1.6	21.3	13.2
Mn	KA1	1.9	2.0	0.0	0.0
Fe	KA1	8.6	1.9	6.7	3.4
Cu	KA1	131.5	2.0	129.5	63.5

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/02/12

Indexing of negative number: 43896 SCOPE #: 2

Reference / Sample Number: 0017

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.55 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.25	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.26**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	7.32	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.56**	**4.58**	**4.351**	**4.809**

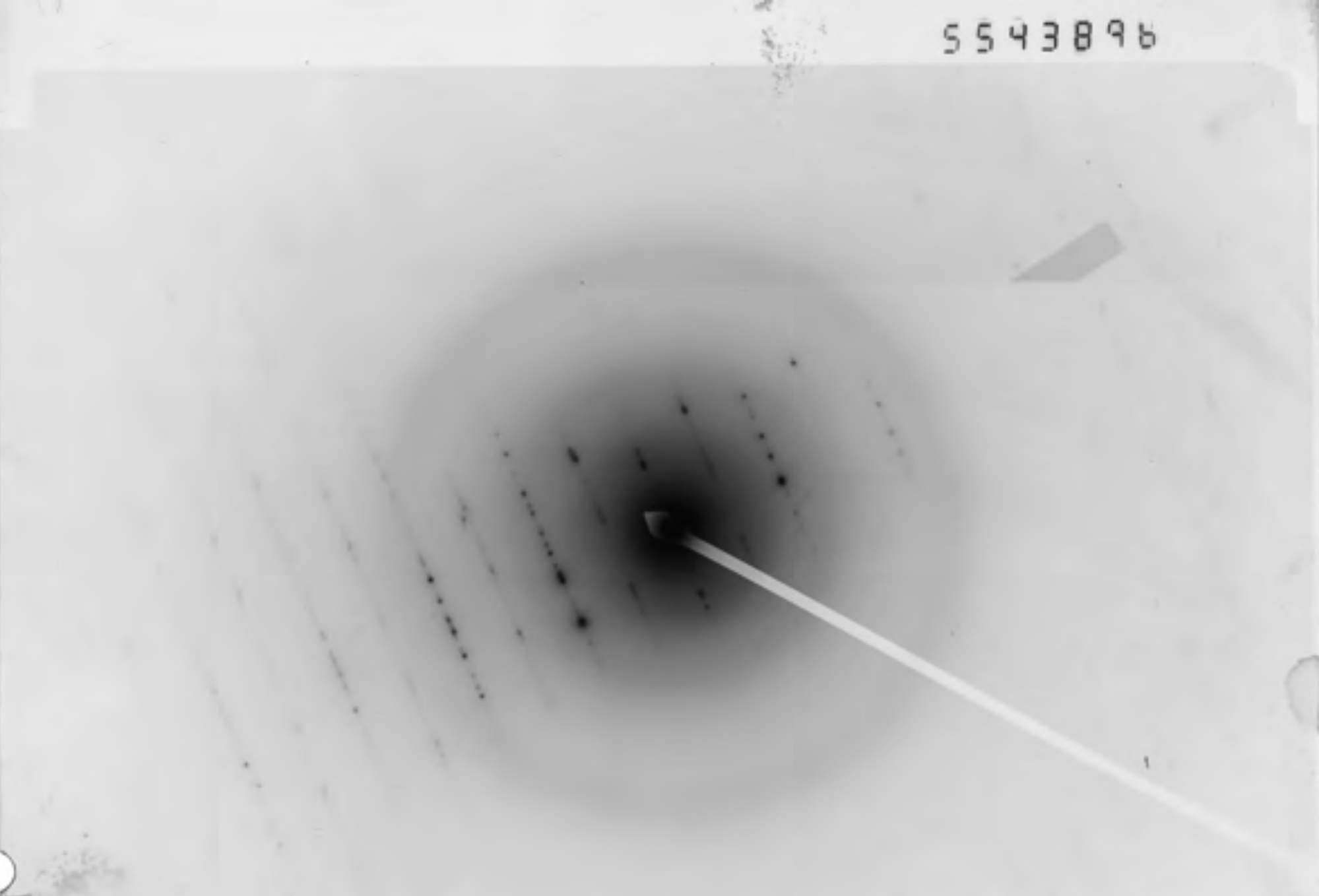
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

5543896



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0018	Volume (L):	1717	Scope:	09-0 2
Customer Sample:	HM-MS-AA-05	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	J, 1-3	Analysis Date:	9/23/2012

Analysis Information

Target Sensitivity: 0.002 s/cc

GO Required: 9

GO Analyzed: 9

Level of Analysis Chrysotile: CD~~Q~~ inbulk only

Level of Analysis Amphibole: ADX

Minimum Aspect Ratio: (circle one) none | 3:1 | 5:1

Min Length: > 5 micron

Min Width: 0.25 micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
J1	E1	B	1	1	17.8	3.5	CD	CHRYS		43899	
J1	E3	B	2	2	8.8	0.45	CDQ	CHRYS			YES
J1	E3	B	3	3	11.8	2.3	CD	CHRYS			
J1	E3	B	4	4	12.2	1.4	CD	CHRYS			
J1	E5	B	5	5	5.7	1.3	CD	CHRYS			
J1	E7	B	6	6	11.2	2.1	CD	CHRYS			
J1	E7	B	7	7	11	2.4	CD	CHRYS			
J1	E9	B	8	8	36.4	5.6	CD	CHRYS			
J1	E9	B	9	9	10.1	2.8	CD	CHRYS			
J1	E9	MD11	10		9.8	12.4	CD	CHRYS			

ISO 10312

091211943-0018

TEM Asbestos Count Sheet

J1	E9	MB		10	5.6	0.7	CD	CHRYS			
J1	D1	None Detected									
J2	D3	None Detected									
J3	E4	B	11	11	14.9	3.8	CD	CHRYS			
J3	E4	B	12	12	7.55	1.8	CD	CHRYS			
J3	E6	B	13	13	11.55	3.5	CD	CHRYS			
J3	E6	B	14	14	5.95	1.2	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

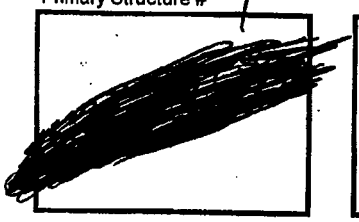
Structure Sketch Sheet

EMSL Order ID: 0912119413-0018 **Client:**

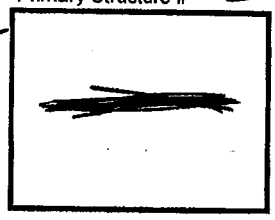
Client Sample:

Page 1 of 1

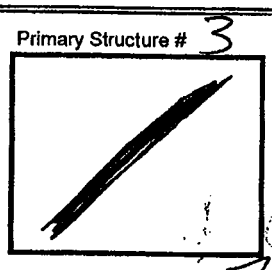
Primary Structure # 1



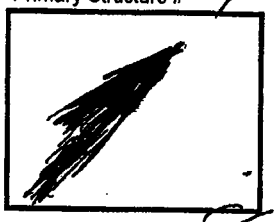
Primary Structure # 2



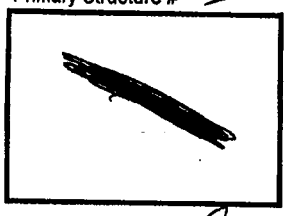
Primary Structure # 3



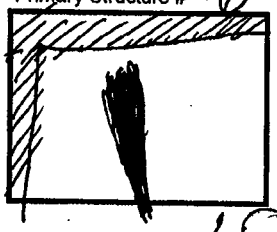
Primary Structure # 4



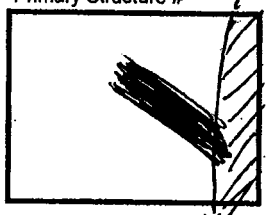
Primary Structure # 5



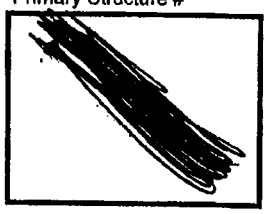
Primary Structure # 6



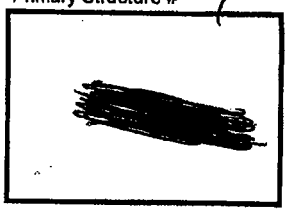
Primary Structure # 7



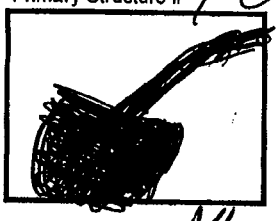
Primary Structure # 8



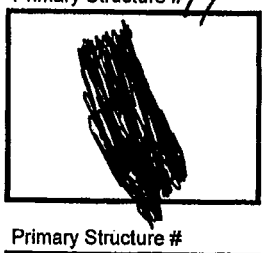
Primary Structure # 9



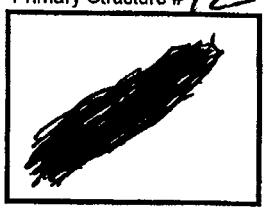
Primary Structure # 10



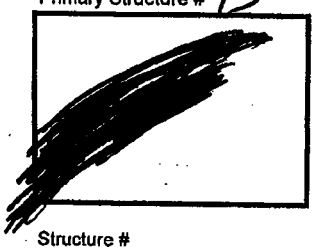
Primary Structure # 11



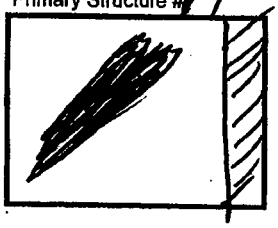
Primary Structure # 12



Primary Structure # 13



Primary Structure # 14



Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

Analyst: KD

Date: 25 Sept 12

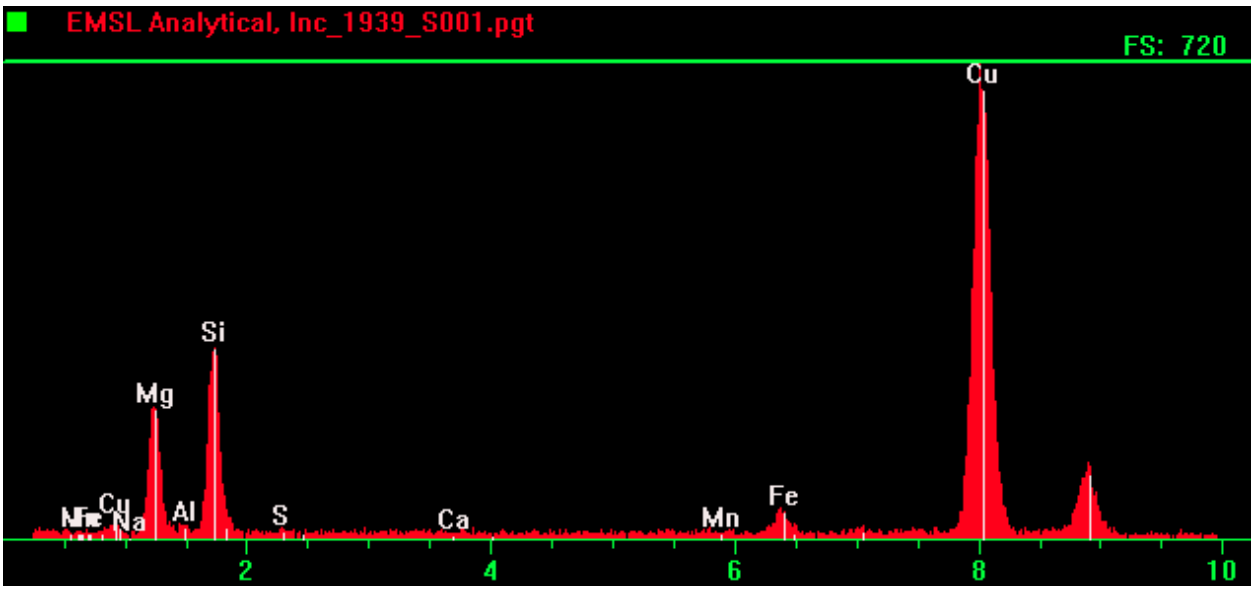
Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0018_TEM_ISO_10312_EDX_Chrysotile
Collected: September 25, 2012 12:21:12

Live Time:	37.05	Count Rate:	1529	Dead Time:	19.03 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	4.5	5.0	0.0	0.0
Mg	KA1	104.7	5.2	99.5	19.2
Al	KA1	11.2	6.1	5.1	0.8
Si	KA1	150.6	6.1	144.5	23.8
S	KA1	7.9	5.9	2.0	0.3
Ca	KA1	7.4	5.9	1.6	0.3
Mn	KA1	8.5	6.8	1.7	0.2
Fe	KA1	29.9	6.8	22.9	3.4
Cu	KA1	546.9	8.4	538.5	63.9

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/02/12

Indexing of negative number: 43899 SCOPE #: 2

Reference / Sample Number: 0018

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

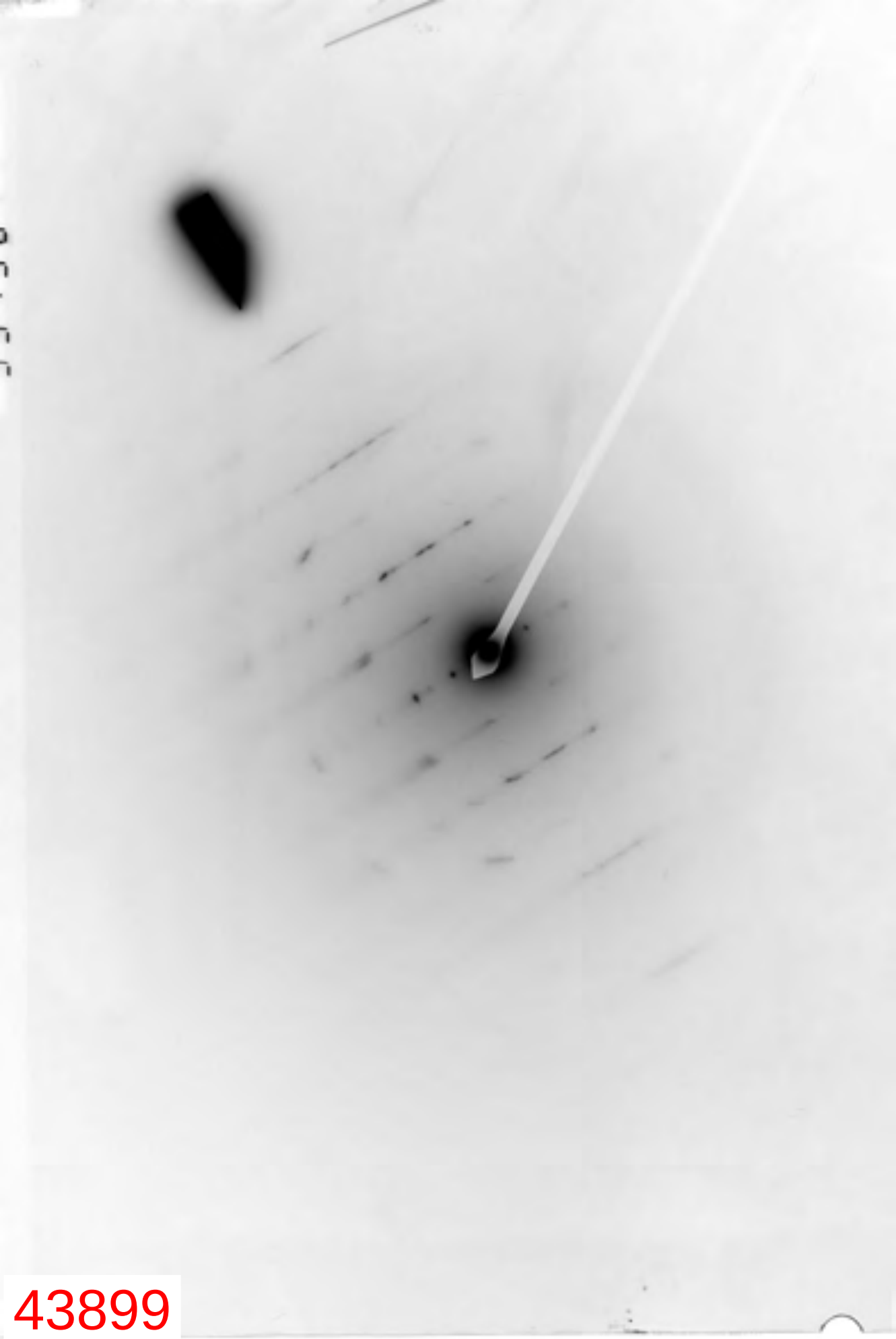
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43899

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0019**	Volume (L):	1694	Scope:	09-02
Customer Sample:	HM-MS-AA-06	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	J, 4-6	Analysis Date:	9/25/2012

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	9	none	3:1	5:1	
GO Analyzed:	9				
Level of Analysis Chrysotile:	CD~~Q~~ 11/26/12 DYM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
J4	E1	B	1	1	7.2	2.1	CDQ	CHRYS		43900	YES
J4	E3	ND									
J4	E5	ND									
J5	F1	ND									
J5	F3	B	2	2	7.4	1.6	CD	CHRYS			
J5	F5	B	3	3	7.2	1.5	CD	CHRYS			
J6	F1	ND									
J6	F3	B	4	4	6.5	2.8	CD	CHRYS			
J6	F3	B	5	5	7.8	1.2	CD	CHRYS			
J6	F5	B	6	6	10.2	0.5	CD	CHRYS			

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312

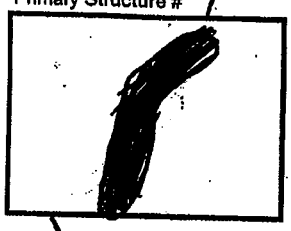
Structure Sketch Sheet

EMSL Order ID: 0912 11943-0019 **Client:**

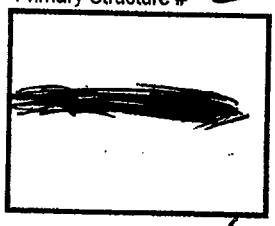
Client Sample:

Page 1 of 1

Primary Structure # 1



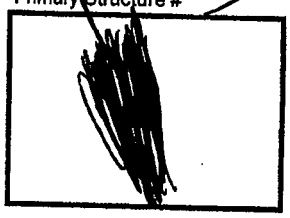
Primary Structure # 2



Primary Structure # 3

Primary Structure # 4

Primary Structure # 5



Primary Structure # 6

Primary Structure #

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Primary Structure #

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Structure #

Structure #

Structure #

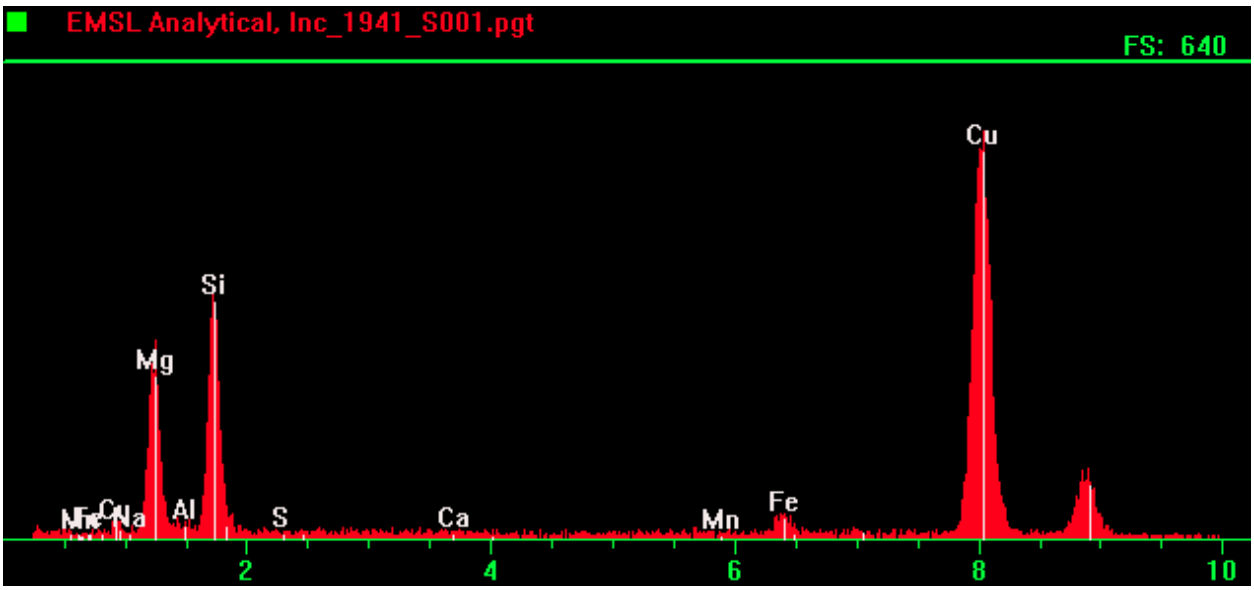
Analyst: KD Date: 25 Sept 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0019_TEM_ISO_10312_EDX_Chrysotile
Collected: September 25, 2012 16:27:51

Live Time:	34.11	Count Rate:	1477	Dead Time:	17.81 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	6.0	6.1	0.0	0.0
Mg	KA1	139.3	6.9	132.4	19.2
Al	KA1	12.8	7.3	5.4	0.7
Si	KA1	184.8	6.9	177.9	25.6
S	KA1	6.7	6.3	0.4	0.1
Ca	KA1	7.3	5.5	1.9	0.3
Mn	KA1	7.3	7.0	0.3	0.0
Fe	KA1	26.6	7.4	19.2	2.6
Cu	KA1	468.5	8.0	460.4	57.5

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/02/12

Indexing of negative number: 43900 SCOPE #: 2

Reference / Sample Number: 0019

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.4 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.00	mm

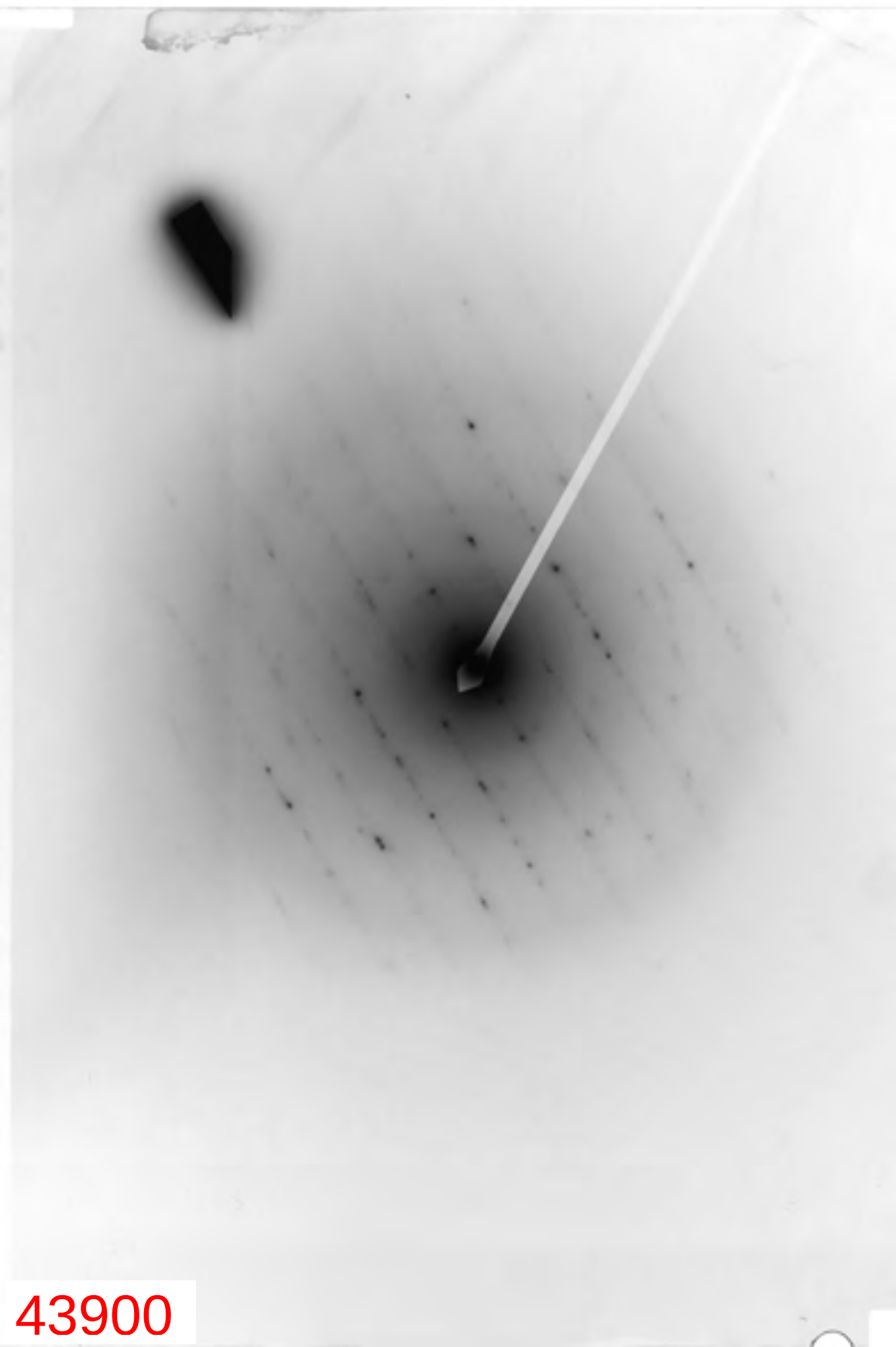
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.44**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.79**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43900

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0020**	Volume (L):	595	Scope:	09-02
Customer Sample:	HM-AP-ATV-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	K, 13	Analysis Date:	9/25/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	13	none	3:1	5:1	OVERLOADED
GO Analyzed:	0				30%
Level of Analysis Chrysotile:	CDØ illegible	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX DVM	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0020**	Volume (L):	595	Scope:	04-01
Customer Sample:	HM-AP-ATV-01	Prepped By:	PK	GO area (mm2):	~~0.0132~~ 0.0129 RD 11.15.12
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	K, 13	Analysis Date:	11/7/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	13		none	3:1	5:1
GO Analyzed:	13				
Level of Analysis Chrysotile:	CD~~X~~ 11/29/12 DM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:
35% PART LOADING
VERTICAL TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K1	H2	MP11	0		13	3.5					
		MB		0	13	.7	CD	CH		011372	1
		MC11	1	1	9.5	1	CD	CH			
	H7	MP11	0		21.5	14.5					
		MF		0	11.1	1.2	ADX	NRA		011373	1
		MC11	0	0	12	8.5	ADX	NRA			
	G5	MP11	2		6	1.6					
		MB		2	6	.3	CD	CH			
	F2	NO									
	D1	B	3	3	10	1	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0020**	Volume (L):	595	Scope:	04-01
Customer Sample:	HM-AP-ATV-01	Prepped By:	PK	GO area (mm2):	~~0.0132~~ .0129 11/29/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	K, 13	Analysis Date:	11/7/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)	none	3:1	5:1
GO Required:	13				
GO Analyzed:	13				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	≥0.25	micron	

Comments: 35% PART LOADING VERTICAL TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K1	D6	ND									
	B5	F	4	4	8.3	.5	ADX	TREM		011377	1
K2	I2	MD22	5		35	5					
		MF		0	21	.09	CD	CH			
		MB		5	7.5	.75	CD	CH	0 5		
	H8	MD11	6		8.7	1.3					
		MF		6	8.7	.6	ADX	ACT		011379	1
	G4	MD22	7		56	28					
		MF		7	16	1.6	ADX	ACT			
		MF		8	8.1	.6	ADX	ACT	7 8 NAM NAM	011381	

ISO 10312

TEM Asbestos Count Sheet

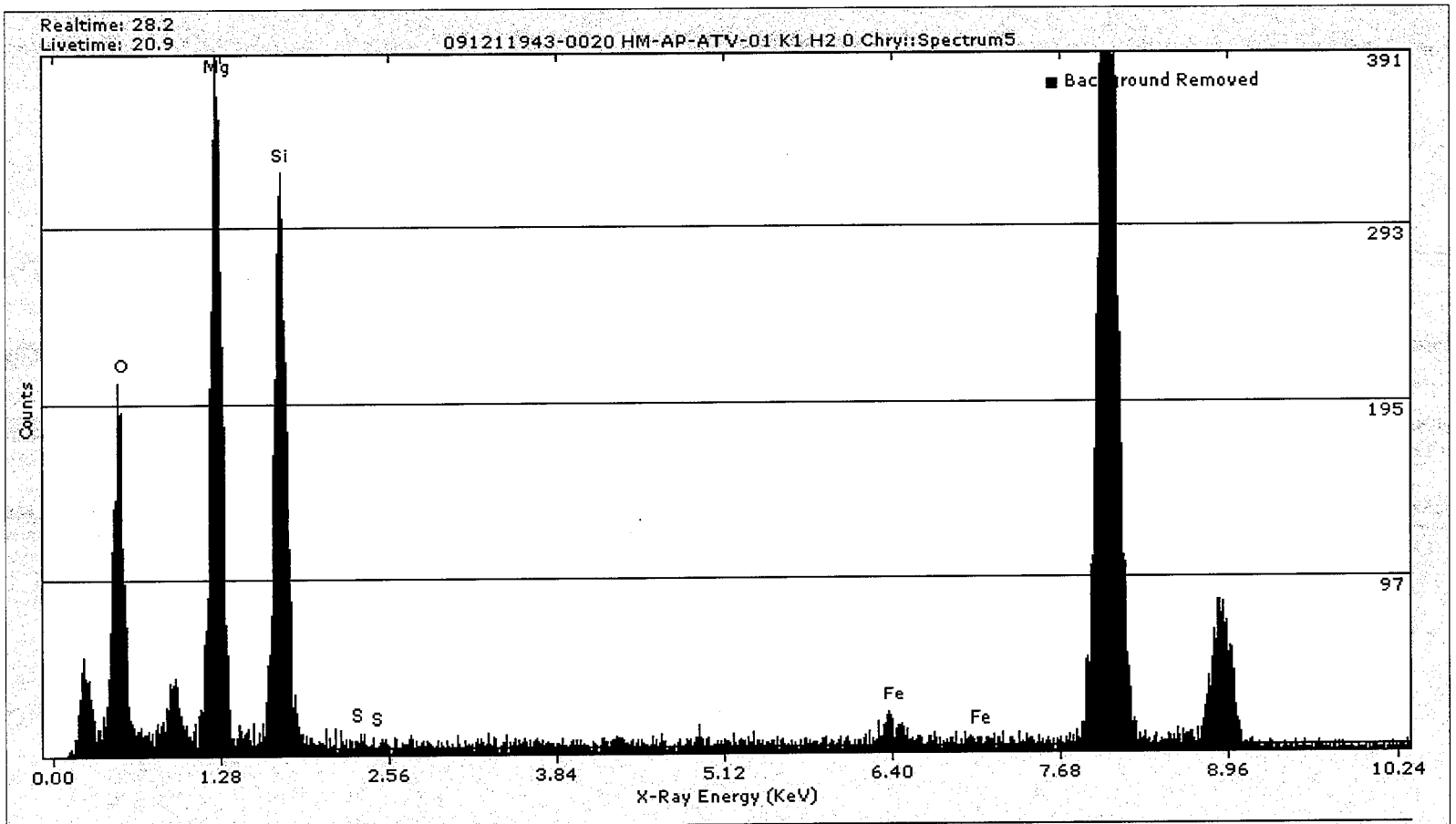
EMSL Sample ID:	**091211943-0020**	Volume (L):	595	Scope:	04-01
Customer Sample:	HM-AP-ATV-01	Prepped By:	PK	GO area (mm2):	~~0.0132~~ .0129 11/29/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	K, 13	Analysis Date:	11/7/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)	none	3:1	5:1
GO Required:	13				
GO Analyzed:	13				
Level of Analysis Chrysotile:	CD~~Q~~ 11/29/12 DM	Min Length:	>5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	≥0.25	micron	

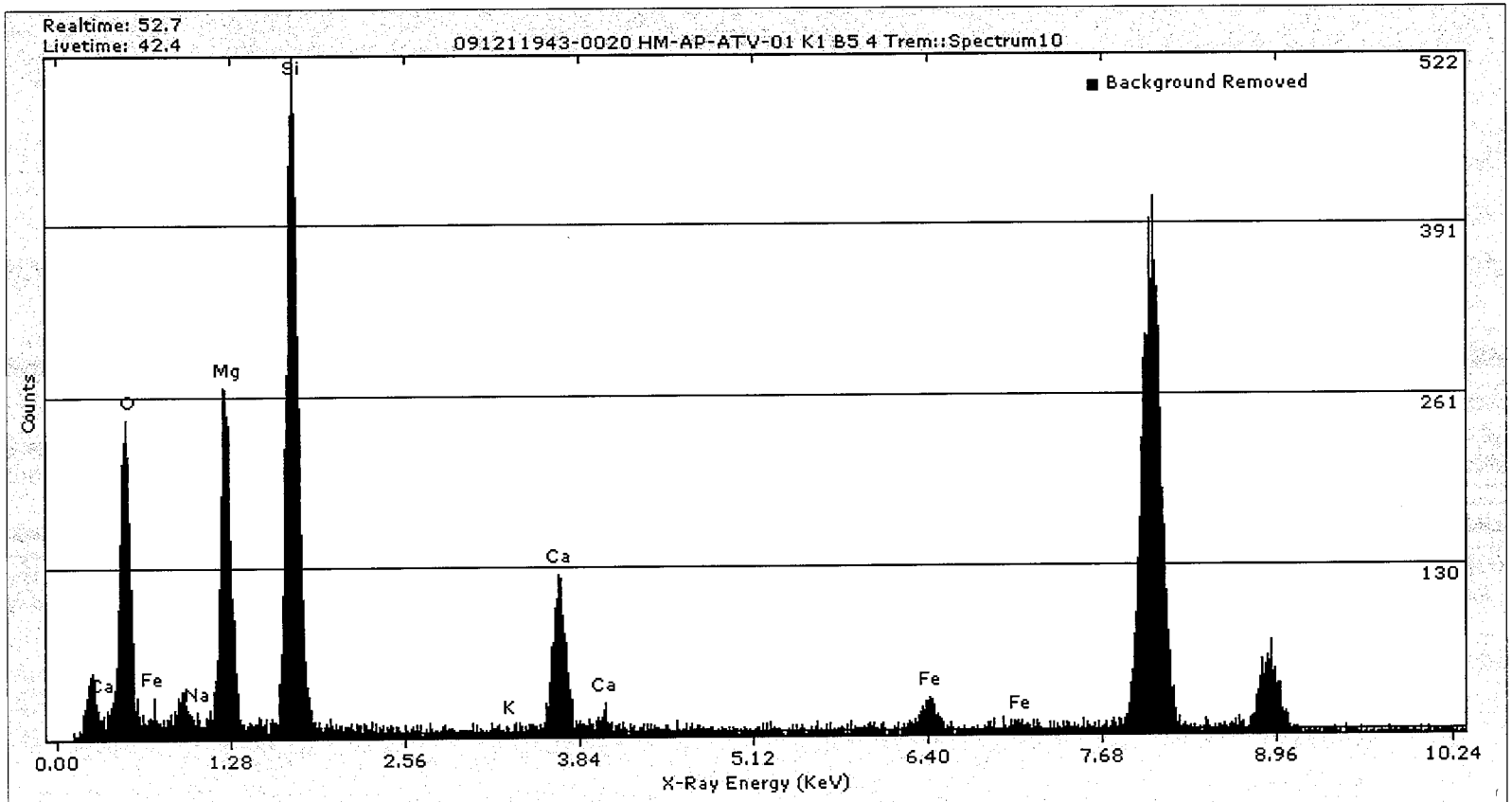
Comments:
35% PART LOADING
VERTICAL TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
K2	G4	MD11	8		12	9					
		MB		9	12	2.1	CD	CH			
		MD11	9		23.7	11.6					
		MB		10	21.8	2.5	CD	CH			
	E2	MC11	0	0	12.6	7	ADX	NRA			
	B1	NP									
	B5	MD11	0		7.6	2					
		MF		0	7.6	1	ADX	NRA			



Quantitative Results for Spectrum5
Analysis: Thin Film Method: Standardless
Acquired 07-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	45.98	1.34	58.12	0.00		0.0000	0.0	85.8	1473.43
Magnesium	30.40	0.55	25.29	50.42	(MgO)	0.4126	3104.5	95.5	2997.96
Silicon	22.41	0.43	16.14	47.95	(SiO2)	0.2860	2668.8	101.4	2699.42
Sulfur	0.07	0.00	0.05	0.18	(SO3)	0.0023	8.9	108.3	32.33
Iron	1.13	0.02	0.41	1.45	(FeO)	0.0073	111.2	146.0	170.17
Total	100.00			100.00					

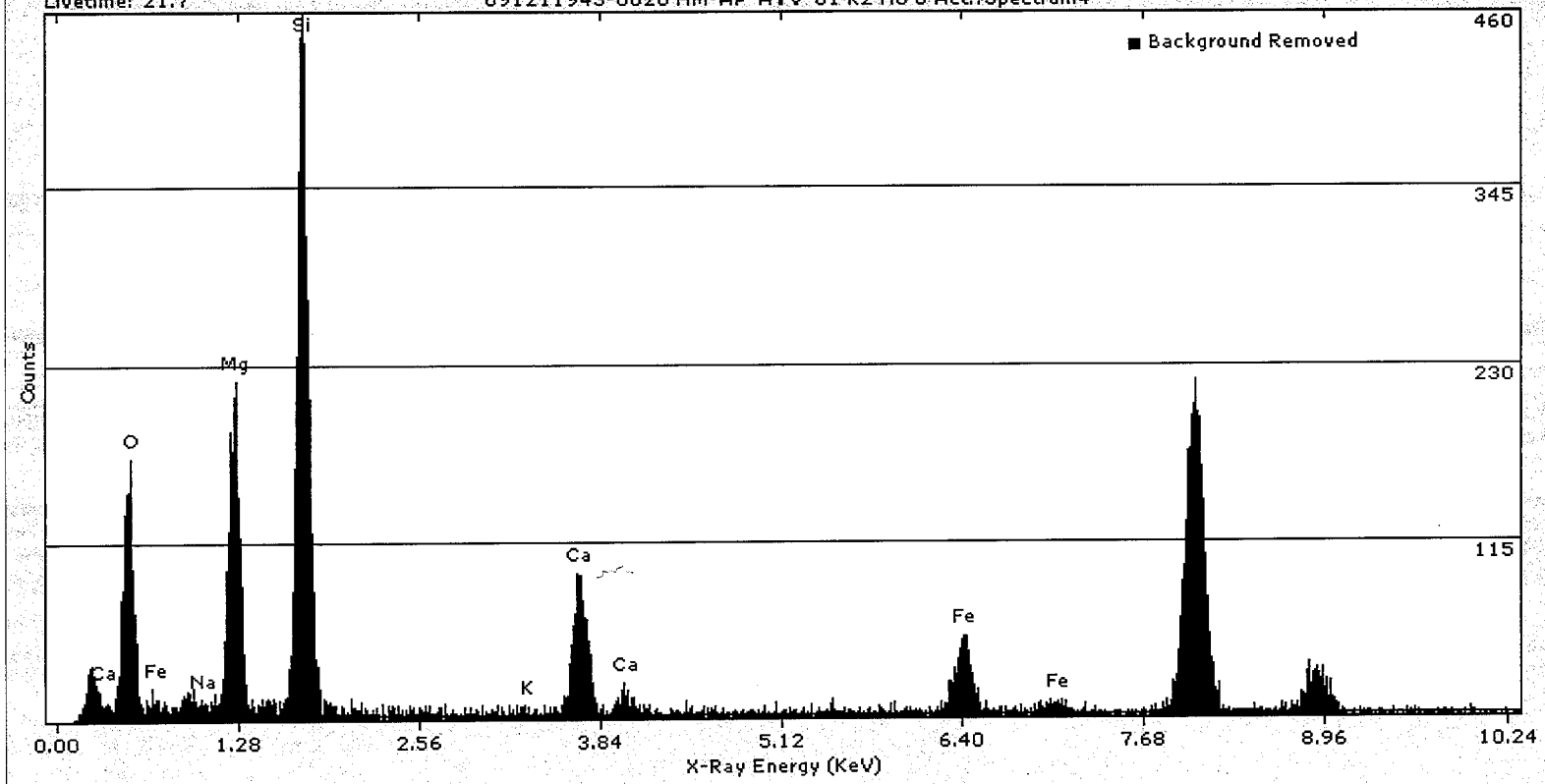


Quantitative Results for Spectrum10
Analysis: Thin Film Method: Standardless
Acquired 07-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.67	1.21	60.76	0.00		0.0000	0.0	85.8	1802.36
Sodium	0.17	0.00	0.16	0.23	(Na2O)	0.0010	16.6	92.8	109.14
Magnesium	15.55	0.24	13.33	25.79	(MgO)	0.2189	1888.8	95.5	1949.77
Silicon	29.11	0.45	21.59	62.29	(SiO2)	0.3892	4123.7	101.4	4205.00
Potassium	0.01	0.00	0.00	0.01	(K2O)	0.0000	0.9	118.4	24.36
Calcium	6.84	0.11	3.55	9.57	(CaO)	0.0551	1007.1	122.2	1135.10
Iron	1.65	0.03	0.62	2.12	(FeO)	0.0136	193.0	146.1	253.87
Total	100.00			100.00					

Realtime: 28.2
Livetime: 21.7

091211943-0020 HM-AP-ATV-01 K2 H8 6 Act::Spectrum4



Quantitative Results for Spectrum4
Analysis: Thin Film Method: Standardless
Acquired 08-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	45.65	0.79	60.47	0.00		0.0000	0.0	85.8	1161.46
Sodium	0.33	0.01	0.31	0.45	(Na2O)	0.0052	27.2	92.8	97.13
Magnesium	14.67	0.25	12.79	24.33	(MgO)	0.2307	1519.7	95.6	1614.72
Silicon	28.00	0.48	21.12	59.90	(SiO2)	0.4119	3382.1	101.4	3565.51
Potassium	0.15	0.00	0.08	0.18	(K2O)	0.0019	18.2	118.2	44.40
Calcium	6.58	0.11	3.48	9.20	(CaO)	0.0567	826.6	122.2	893.41
Iron	4.62	0.08	1.75	5.95	(FeO)	0.0334	461.5	146.2	550.60
Total	100.00			100.00					

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 07, 2012

Image Number: 011372

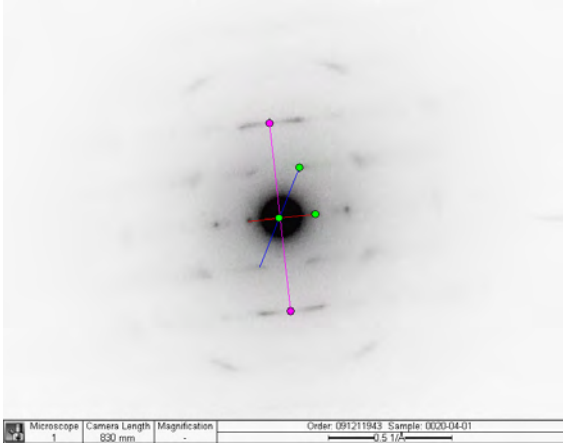
Reference / Sample Number: 0020

Preliminary ID: Chrysotile

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.219**	5.3	**5.06**	**5.56**
Vector Angle:	**62.1**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.321**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.630**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 07, 2012

Image Number: 011377

Sample Number: 0020-04-01

Preliminary ID: Tremolite

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

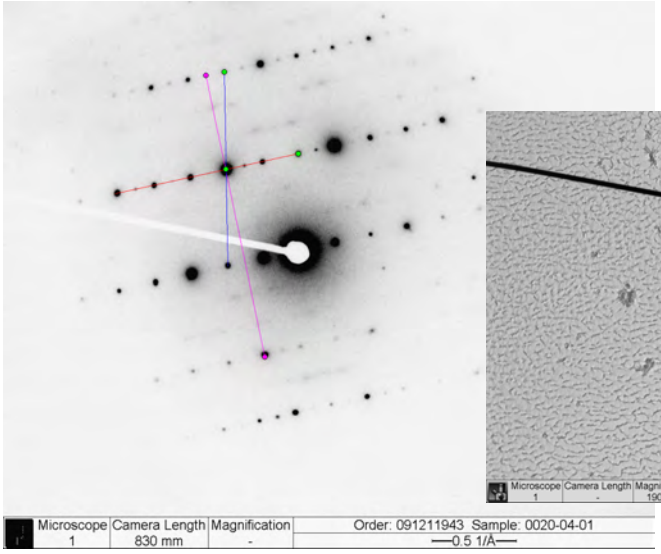
	Measured	Reference	-5%	+5%
Inter-row Spacing:	**1.767**	1.759	**1.671**	**1.847**
d2 or hk0 (Camera K/zero row dist.):	**4.513**	4.510	**4.284**	**4.736**
d1 or hkl (Camera K/slant vector dist.):	**1.750**	1.748	**1.661**	**1.835**
Ratio of hk0/hkl:	**2.579**	2.580	**2.451**	**2.709**
Vector Angle:	**78.7**	78.840	**74.898**	**82.782**

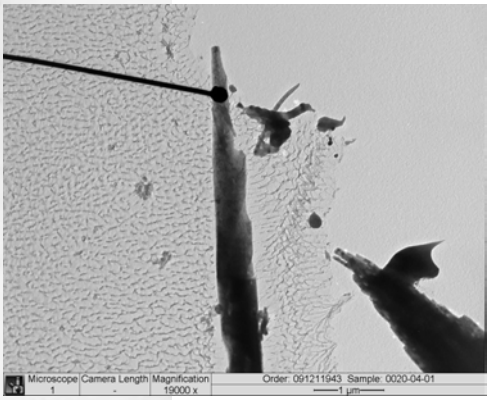
From SAED Reference Book, "unknown" diffraction pattern was found to be that of:

TREMOLITE

With a Zone Axis of:

[**-3 0 -2**]





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By:

F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 08, 2012

Image Number: 011379

Sample Number: 0020-04-01

Preliminary ID: Actinolite

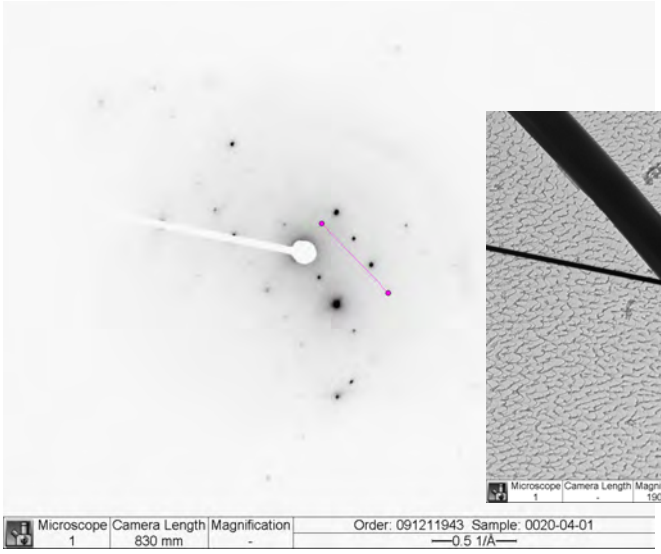
Camera Constant: 2.952e-003 **1/A Pixels**

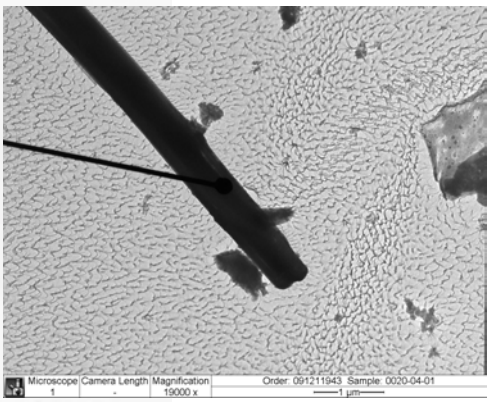
Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.282**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**N/A**	N/A	-	-
d1 or hkl (Camera K/slant vector dist.):	**N/A**	N/A	-	-
Ratio of hk0/hkl:	**N/A**	N/A	-	-
Vector Angle:	**N/A**	N/A	-	-

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Actinolite**

With a Zone Axis of: [**N/A**]





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By:

F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
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AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 08, 2012

Image Number: 011381

Sample Number: 0020-04-01

Preliminary ID: Actinolite

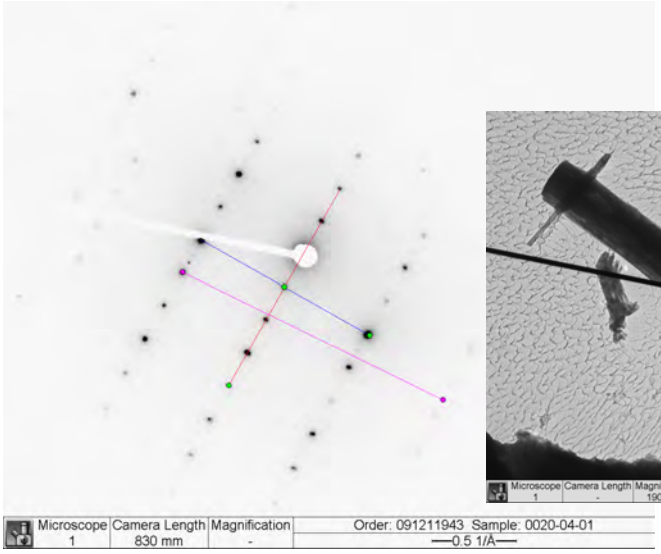
Camera Constant: 2.952e-003 **1/A Pixels**

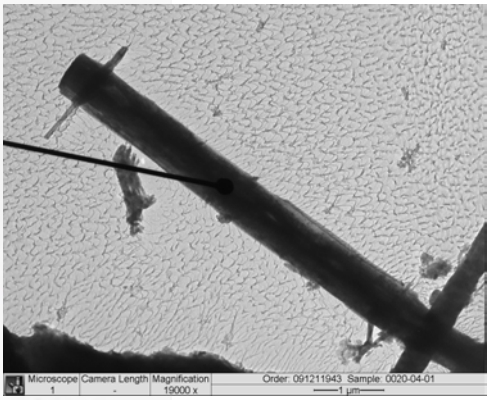
Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**1.759**	1.759	**1.671**	**1.847**
d2 or hk0 (Camera K/zero row dist.):	**4.507**	4.520	**4.294**	**4.746**
d1 or hkl (Camera K/slant vector dist.):	**1.755**	1.750	**1.662**	**1.838**
Ratio of hk0/hkl:	**2.568**	2.583	**2.454**	**2.712**
Vector Angle:	**89.9**	90.000	**85.500**	**94.500**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: With a Zone Axis of:

ACTINOLITE [**3 0 2**]





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By:

F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0021**	Volume (L):	660	Scope:	09-02
Customer Sample:	HM-AP-ATV-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	K, 4-6	Analysis Date:	9/25/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	12	none	3:1	5:1	OVERLOADED
GO Analyzed:	0				35%
Level of Analysis Chrysotile:	CDX 11/26/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0021**	Volume (L):	660	Scope:	04 01
Customer Sample:	HM-AP-ATV-02	Prepped By:	DK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412-ERRG-01	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	G / 1-3	Analysis Date:	11/12/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	~~0~~12	11/29/12 DM			
Level of Analysis Chrysotile:	CD~~0~~		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

40% Particulate Loading
Vertical TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
G1	G1	MD31	1		18	12			6		
		MB		1	18	2.3	CD	CH			
		MR10		0	4	.5	ADX	ACT			
		MR10		0	3.7	.6	ADX	ACT	1 0	011420	1
		MD11	2		13.2	4					
		MB		2	11	.75	CD	CH		011422	1
	I4	MCH	3	3	178	~~8.6~~ 178	CD	CH			
	F3	MD22	4	~~83~~	~~69~~ 83	69	RD 11-15-12		4		
		MB		4	22	1.25	ADX	ACT			
		MB		5	8.2	1	CD	CH		5	

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0021**	Volume (L):	660	Scope:	04 01
Customer Sample:	HM-AP-ATV-02	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412-ERRG-01	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	G / 1-3	Analysis Date:	11/12/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	12	none	3:1	5:1	
GO Analyzed:	~~0~~ 12 11/29/12 DM				40% Particulate Loading
Level of Analysis Chrysotile:	CD~~0~~	Min Length:	>5	micron	Vertical TD
Level of Analysis Amphibole:	ADX	Min Width:	≥0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
G1	F3	MD11	0		48	29					
		MB		0	19	1.3	CD	CH			
	F6	MD22	5		37	42					
		MB		6	18.5	.5	CD	CH			
		MF		7	12	1.2	CD	CH			
		MC11	6	8	41	27	CD	CH			
	D3	MC22	7	9	88	46	ADX	ACT			
		B	8	10	5.5	.75	CD	CH			
		MC22	9	11~~9~~	94	67	CD/ADX	CH/URA	URA		

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0021**	Volume (L):	660	Scope:	04 01
Customer Sample:	HM-AP-ATV-02	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412-ERRG-01	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	G / 1-3	Analysis Date:	11/12/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	~~0~~12 11/29/12 rm				
Level of Analysis Chrysotile:	CD~~Q~~		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

40% Particulate Loading
Vertical TD

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
G1	D3	MD42	10		30	14					
		MB		12	10	.6	CD	CH			
		MF	FC 11/12/12	~~13~~ 9	3	.4	ADX	NRA			1
		MR11		0	7	1.2	NAM	NAM	12		
		MR10		0	5	.4	CD	CH	NAM		
		MC77	11	13	87	63	CD/NAM	CH/NAM			
	B5	MD21	12		12.5	10.2					
		MB		14	10.5	2	CD	CH			
		MR10		0			NAM	NAM			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0021**	Volume (L):	660	Scope:	04 01
Customer Sample:	HM-AP-ATV-02	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412-ERRG-01	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	G / 1-3	Analysis Date:	11/12/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	12	none	3:1	5:1	
GO Analyzed:	~~0~~ 12 11/29/12 DM				40% Particulate Loading
Level of Analysis Chrysotile:	CD~~0~~	Min Length:	>5	micron	Vertical TD
Level of Analysis Amphibole:	ADX	Min Width:	≥0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
G2	I2	MD3~~2~~3	18		44.5	42			0		
		MB		0	8.75	.4	CD	CH			
		MR11		20	13.2	2.2	CD	CH	21		
		MR11		21	10	1	CD	CH	20		
		MD11	0		6.2	1					
		MB		0	5.5	.25	CD	CH			
		MD11	19		49	12.5					
		MB		22	49	7.2	CD	CH			
		MD11	20		28	18					
		MB		23	15.2	2	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0021**	Volume (L):	660	Scope:	04 01
Customer Sample:	HM-AP-ATV-02	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412-ERRG-01	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	G / 1-3	Analysis Date:	11/12/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	12	none	3:1	5:1	
GO Analyzed:	~~12~~ 11/20/12 DM				40% Particulate Loading
Level of Analysis Chrysotile:	CD~~Ø~~	Min Length:	>5	micron	Vertical TD
Level of Analysis Amphibole:	ADX	Min Width:	≥0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
62	I2	MD11	21		7	1.6					
		MF		24	7	.5	ADX	ACT			
	H6	MD11	22		11	1.2					
		MB		25	11	.6	CD	CH			
		MC11	23	26	33	28	CD	CH			
		MC32	24	27	57	44	CD	CH			
	F6	MC11	25	28	54	29	ADX	ACT			
	D8	MD11	26	~~2~~ 3rd 11/20/12	39.0	14.0					
	↓	MB		29	10.0	0.7	CD	CH			
↓	↓	B	~~27~~ PK 11/14/12	30	10.7	0.8	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0021	Volume (L):	660	Scope:	04 01
Customer Sample:	HM-AP-ATV-02	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412-ERRG-01	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	G / 1-3	Analysis Date:	11/12/2012

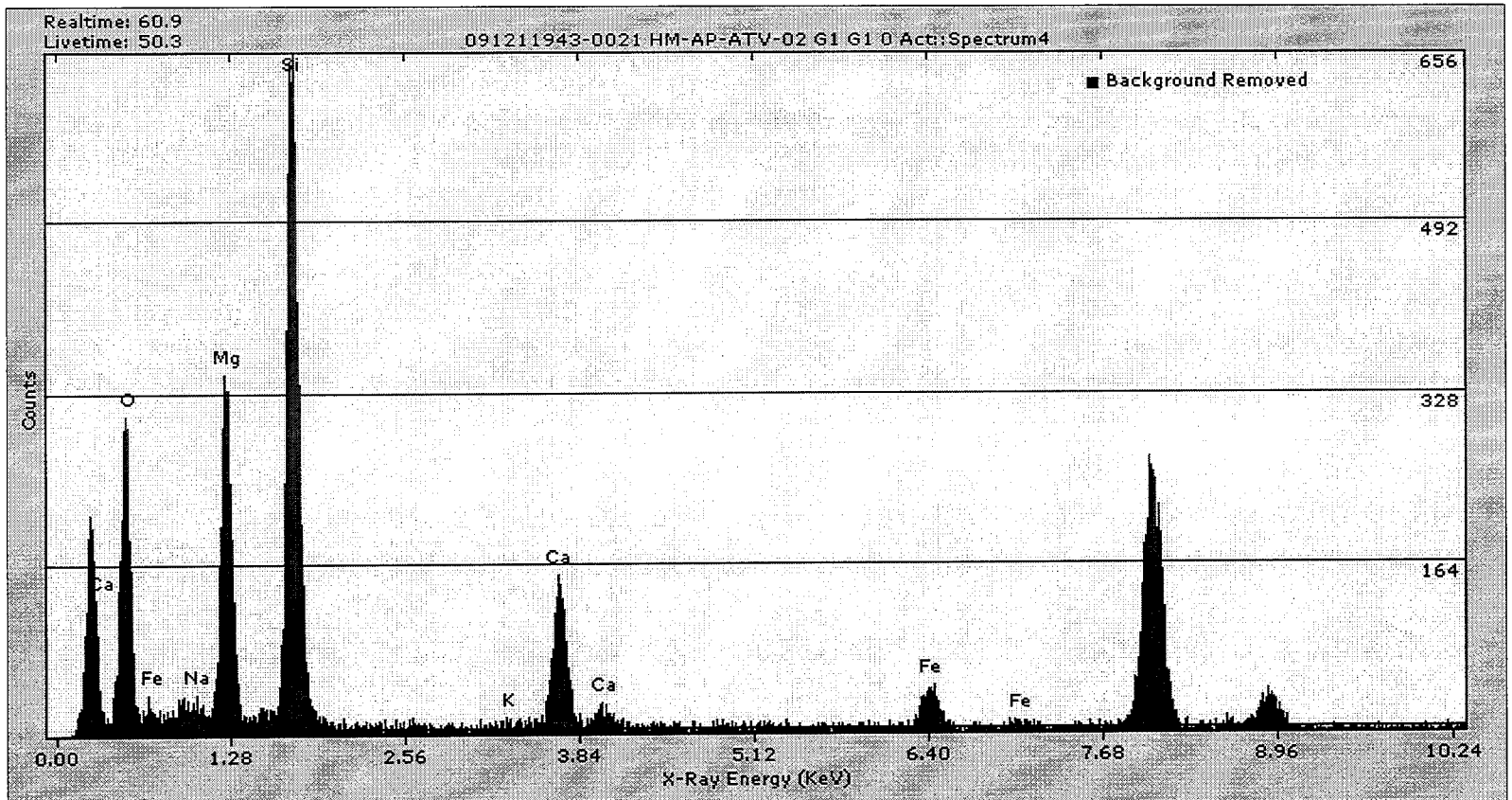
Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	Ø12	11/29/12 OM			
Level of Analysis Chrysotile:	CDØ		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

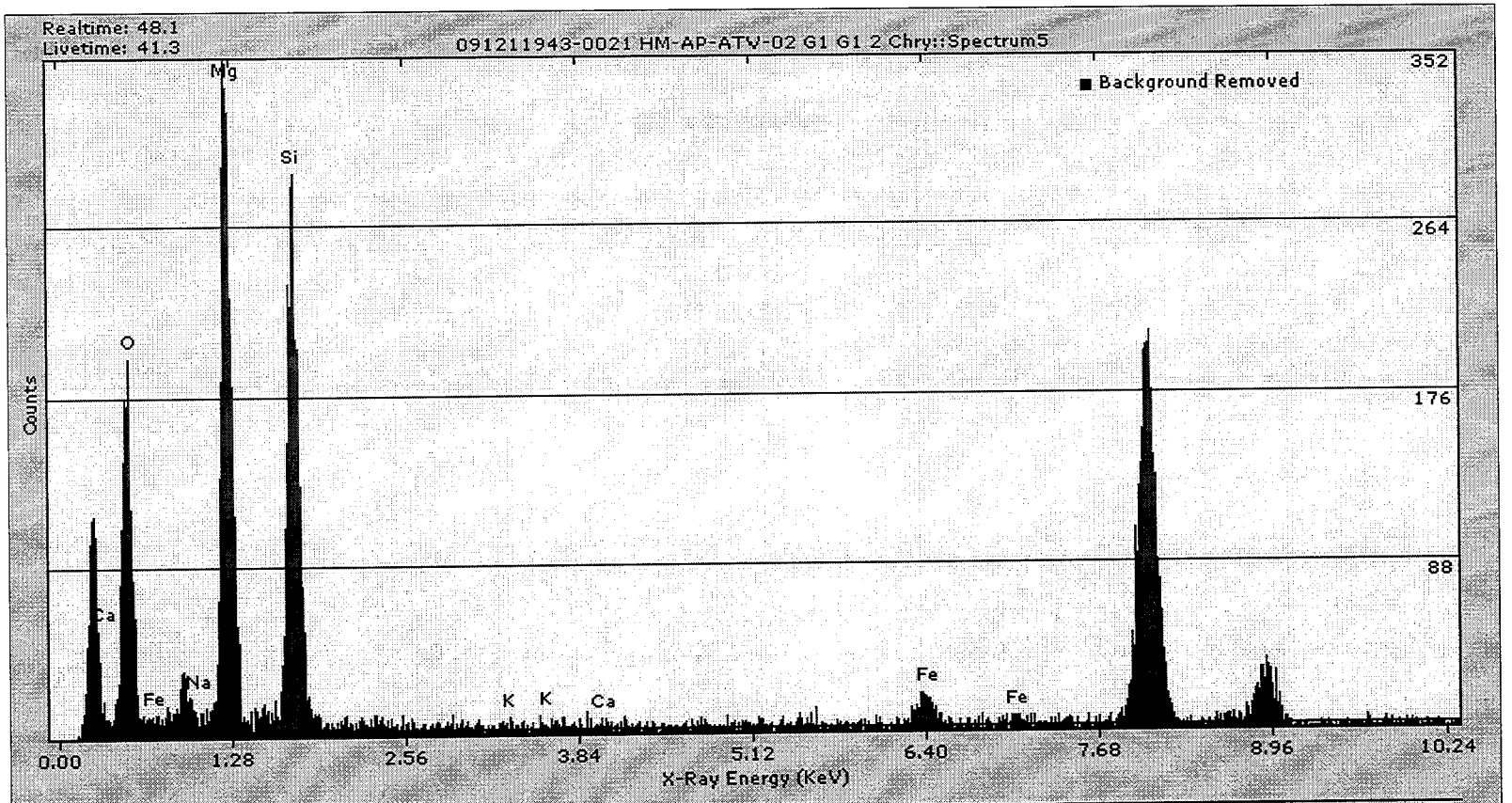
40% Particulate Loading
Vertical TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
G2	C6	F	~~3~~ 28 P43 11/29/12	31	9.0	0.5	ADX	AC			
	↓	B	29	82	17.5	4.0	CD	CH			
	A4	MD11	30		49.0	20.5					
	↓	MB		33	16.3	0.6	CD	CH			



Quantitative Results for Spectrum4
Analysis: Thin Film Method: Standardless
Acquired 12-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.14	0.64	60.35	0.00		0.0000	0.0	85.8	2223.61
Sodium	0.69	0.01	0.63	0.93	(Na2O)	0.0091	85.3	92.8	240.02
Magnesium	15.65	0.22	13.47	25.95	(MgO)	0.2233	2438.2	95.6	2614.42
Silicon	28.21	0.39	21.02	60.36	(SiO2)	0.3792	5126.1	101.4	5424.78
Potassium	0.01	0.00	0.00	0.01	(K2O)	0.0001	1.4	118.6	54.80
Calcium	7.00	0.10	3.66	9.80	(CaO)	0.0536	1323.9	122.2	1400.54
Iron	2.29	0.03	0.86	2.95	(FeO)	0.0179	344.3	146.2	441.70
Total	100.00			100.00					



Quantitative Results for Spectrum5
Analysis: Thin Film Method: Standardless
Acquired 12-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	45.78	0.94	58.11	0.00		0.0000	0.0	85.8	1358.28
Sodium	0.30	0.01	0.27	0.41	(Na2O)	0.0042	19.5	92.8	106.17
Magnesium	29.33	0.60	24.51	48.63	(MgO)	0.3819	2390.3	95.6	2540.70
Silicon	22.65	0.46	16.38	48.46	(SiO2)	0.2777	2157.5	101.4	2288.29
Potassium	0.08	0.00	0.04	0.10	(K2O)	0.0016	7.8	118.3	23.88
Calcium	0.07	0.00	0.03	0.10	(CaO)	0.0013	6.8	122.2	
Iron	1.79	0.04	0.65	2.31	(FeO)	0.0129	140.9	146.0	188.71
Total	100.00			100.00					

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 12, 2012

Image Number: 011420

Sample Number: 0021-04-01

Preliminary ID: Actinolite

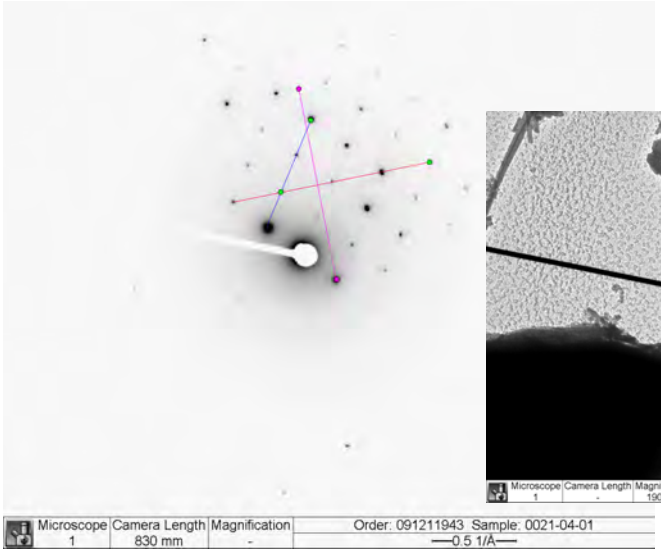
Camera Constant: 2.952e-003 **1/A Pixels**

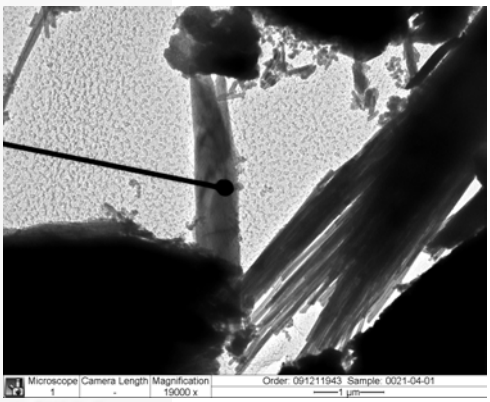
Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.281**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**3.387**	3.385	**3.216**	**3.554**
d1 or hkl (Camera K/slant vector dist.):	**4.410**	4.482	**4.258**	**4.706**
Ratio of hk0/hkl:	**0.768**	0.755	**0.717**	**0.793**
Vector Angle:	**56.7**	57.000	**54.150**	**59.850**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: **[5 -1 2]**





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 12, 2012

Image Number: 011422

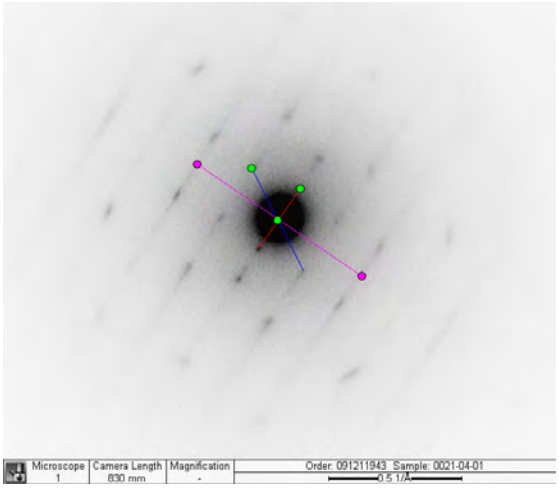
Reference / Sample Number: 0021

Preliminary ID: Chrysotile

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.322**	5.3	**5.06**	**5.56**
Vector Angle:	**60.7**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.312**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.618**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
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CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 12, 2012

Image Number: 011423

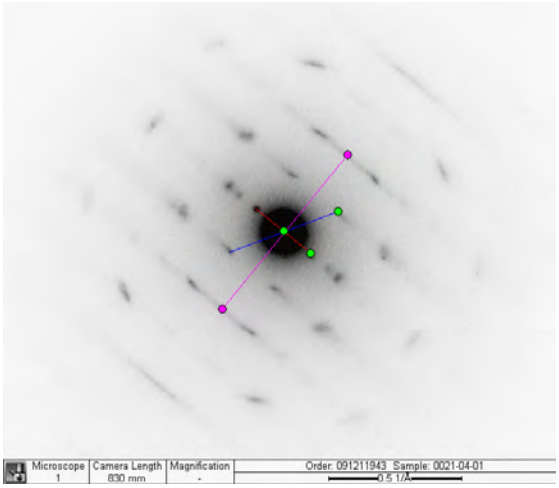
Reference / Sample Number: 0021

Preliminary ID: Chrysotile

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.369**	5.3	**5.06**	**5.56**
Vector Angle:	**59.8**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.360**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.594**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0022**	Volume (L):	568	Scope:	09-02
Customer Sample:	HM-AP-ATV-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	L, 1-3	Analysis Date:	9/25/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	14	none	3:1	5:1	OVERLOADED
GO Analyzed:	0				18%
Level of Analysis Chrysotile:	CD~~Ø~~ illegible	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0022**	Volume (L):	568	Scope:	04-03
Customer Sample:	HM-AP-ATV-03	Prepped By:	PK	GO area (mm2):	~~0.0152~~ 0.0129 RD 11.15.12
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	Pitarmsen
EFA (mm^2):	385	Grid Location:	L, 1-3	Analysis Date:	11/2/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	14		none	3:1	5:1
GO Analyzed:	14	11/29/12 DM			
Level of Analysis Chrysotile:	CD~~Q~~		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments: * Fiber contains elevated level of Na & K.
Pictures of loading numbers: 03517, 03518, 03519, 03520

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
L1	H6	B	1	1	8.7	2.5	CDQ	CH		03521	✓
↓	↓	MD11	2		6.8	3.0					
↓	↓	MB		2	6.5	1.0	CD	CH			
↓	↓	B	3	3	5.4	0.7	CD	CH			
L2	A9	B	4	4	5.2	1.1	CD	CH			
↓	↓	B	5	5	6.0	1.2	CD	CH			
↓	↓	B	0	0	9.0	1.2	CD	CH			
↓	↓	MD55	6		18.0	17.5					
↓	↓	MF		6	11.2	2.0	ADX	~~AC~~ NRA			
↓	↓	MF		7	15.5	0.4	ADX	~~AC~~ NRA	*		✓ PK 11/21/12

11/29/12 DM

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0022	Volume (L):	568	Scope:	04-03
Customer Sample:	HM-AP-ATV-03	Prepped By:	PK	GO area (mm2):	~~0.0132~~ .0129 11/2/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	PHarrison
EFA (mm^2):	385	Grid Location:	L, 1-3	Analysis Date:	11/2/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	14		none	3:1	5:1
GO Analyzed:	14				
Level of Analysis Chrysotile:	CD~~Ø~~	11/2/12 DM	Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments: * Fiber contains elevated level of Na & K

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
L2	A9	MF		8	8.0	0.4	ADX	AC			
		MB		9	8.0	1.1	CD	CH	see above		
		MF		10	7.0	0.5	ADX	AC		03522	Y
		MD11	7		13.0	7.0					
		MF		11	8.0	0.4	ADX	~~AC~~ NRA 11/2/12 DM	*		
	B6	MD11	8		10.5	8.0					
		MF		12	7.0	1.2	ADY	AC			
		MD11	9		18.0	~~1.1~~ 2.0					
		MF		13	8.5	1.6	ADX	AC			
		MD11	10		10.5	2.5					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0022**	Volume (L):	568	Scope:	01-03
Customer Sample:	HM-AP-ATV-03	Prepped By:	PK	GO area (mm2):	~~0.0132~~ .0129 11/29/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	PHarrison
EFA (mm^2):	385	Grid Location:	L, 1-3	Analysis Date:	11/2/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	14		none	3:1	5:1
GO Analyzed:	14				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
L2	B6	MB		14	8.0	1.0	CD	CH			
↓	↓	MO4	0		7.0	4.0					
	↓	MO	PK 11/12 ~~0~~	0	5.5	2.0	~~ADX~~	~~AC~~	doesn't meet AP	11/29/12 DM	
	C10	B	11	15	5.5	1.1	CD	CH			
	↓	B	12	16	8.0	2.0	CD	CH			
	↓	F	13	17	7.2	2.0	ADX	11/6/12 AC			
	↓	MO11	14		12.3	1.7					
	↓	MB		18	10.7	0.9	CD	CH			
	D5	B	15	19	5.7	0.7	CD	CH			
↓	↓	MO11	16		15.0	8.0					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0022	Volume (L):	568	Scope:	04-03
Customer Sample:	HM-AP-ATV-03	Prepped By:	PK	GO area (mm2):	~~0.0152~~ .0129 11/29/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	PHarrison
EFA (mm^2):	385	Grid Location:	L, 1-3	Analysis Date:	11/2/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	14		none	3:1	5:1
GO Analyzed:	14				
Level of Analysis Chrysotile:	~~CDQ~~ 11/29/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments: * Fiber contains elevated levels of Na & K

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F2	D5	MF		20	10.5	0.8	ADX	NRA ~~AC~~ DM 11/29/12	*		
↓	↓	B	17	21	5.2	0.6	CD	CH			
	E7	F	18	22	7.0	0.4	ADX	AC			
		MD11	19		37.0	10.0					
		MB		23	18.0	2.0	CD	CH			
		MD11	20		12.0	5.0					
		MB		24	11.0	1.5	CD	CH			
		B	21	25	~~12.5~~ 25 PH 11/29/12	2.0	CD	CH			
	↓	B	22	26	12.5	1.5	CD	CH			
↓	G6	B	23	27	6.4	0.4	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0022**	Volume (L):	568	Scope:	04-03
Customer Sample:	HM-AP-ATV-03	Prepped By:	PK	GO area (mm2):	~~0.0132~~ .0129 11/29/12 pm
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	Pitarmian
EFA (mm^2):	385	Grid Location:	L, 1-3	Analysis Date:	11/2/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	14		none	3:1	5:1
GO Analyzed:	14				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 pm		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F2	G6	MD~~12~~	24		15.0	12.0					
		MF		28	~~0.6~~ 6.0 11/4/12	0.6	ADX	AC	29		
		MF		29	5.3	0.6	ADX	AC	28		
		B	25	30	12.5	0.7	CD	CH			
F3	A3	B	0	0	28.3	1.5	CD	CH			
		MD22	26		20.0	11.0			31		
		MB		31	19.0	0.7	CD	CH			
		MF		32	5.5	0.6	ADX	AC	32		
	B6	MD11	27		19.0	11.0					
		MF		33	6.0	0.6	ADX	AC			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0022**	Volume (L):	568	Scope:	04-03
Customer Sample:	HM-AP-ATV-03	Prepped By:	PK	GO area (mm2):	~~0.0131~~ .0129 11/29/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	PHarrison
EFA (mm^2):	385	Grid Location:	L, 1-3	Analysis Date:	11/2/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		**Comments:**
GO Required:	14		none	3:1	5:1
GO Analyzed:	14				
Level of Analysis Chrysotile:	CD~~Q~~ 11/29/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F3	B8	B	28	34	23.0	1.5	CD	CH			
	C6	MD11	29		20.0	15.0					
	↓	MF		35	9.0	0.4	ADX	AC			
	↓	B	30	36	6.7	0.5	CD	CH			
	D4	F	31	37	12.0	0.7	ADX	AC			
	↓	B	32	38	10.1	1.3	CD	CH			
	E7	B	33	39	9.5	0.7	CD	CH			
	↓	MD11	34		5.7	5.0					
	↓	MB		40	5.7	0.4	CD	CH			
	↓	F	35	41	5.1	0.4	ADX	AC			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0022	Volume (L):	568	Scope:	04-03
Customer Sample:	HM-AP-ATV-03	Prepped By:	PK	GO area (mm2):	~~0.0152~~ .0129 11/20/12 DM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	PHarrison
EFA (mm^2):	385	Grid Location:	L, 1-3	Analysis Date:	11/2/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	14		none	3:1	5:1
GO Analyzed:	14				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/20/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments: Fiber contains elevated level of Na.

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F3	E7	F	36	42	6.2	0.6	ADX	~~AC~~ NRA 11/20/12 DM			
	F4	MD11	37		25.0	10.0					
		MB		43	10.0	1.2	~~X~~ CD 11/20/12	CH			
		MD11	0		10.0	~~6.0~~ 11/20/12					
		MF		0	5.5	0.8	ADX	AC			
		B	38	44	12.0	0.8	CD	CH			
		F	39	45	10.2	1.5	ADX	AC			
		F	40	46	6.3	0.9	ADX	AC			
		B	41	47	22.5	0.9	CD	CH			
	G9	B	42	48	11.5	1.0	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0022	Volume (L):	568	Scope:	04-03
Customer Sample:	HM-AP-ATV-03	Prepped By:	PK	GO area (mm2):	~~0.0195~~ .0129 11/20/12 OM
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	PHarrison
EFA (mm^2):	385	Grid Location:	L, 1-3	Analysis Date:	11/2/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	14	none	3:1	5:1	
GO Analyzed:	14				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/20/12 OM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F3	G9	B	43	49	5.2	1.0	CD	CH			
		B	44	50	12.0	1.5	CD	CH			
		MD22	45		28.0	13.0					
		MB		51	16.5	1.5	CD	CH			
		MB		52	13.7	0.6	CD	CH			
		MD11	46		15.0	8.0					
		MB		53	9.0	0.5	CD	CH			
		B	47	54	25.0	1.5	CD	CH			

Energy Dispersive X-Ray Analysis Quantitative Spectra & Data

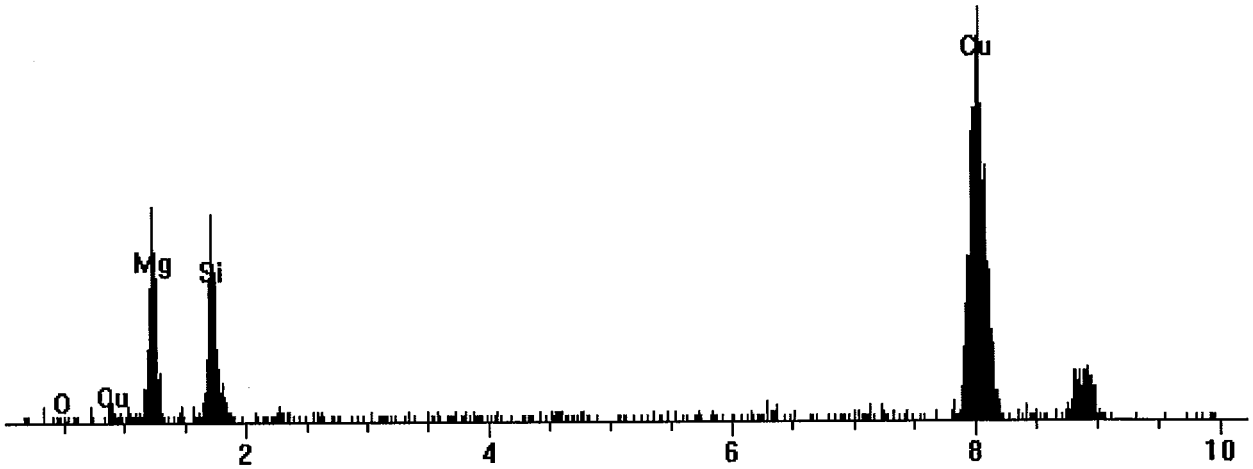
EMSL ANALYTICAL, INC.

File: L:\EDS Spe...Spectra\Scope 04-03\2012\091211943-0022 L1 H6 1 CH.pgt
Collected: Nov 2, 2012 09:58:53

Live Time:	39.16	Count Rate:	134	Dead Time:	3.00 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	55247.27				

■ 091211943-0022 L1 H6 1 CH.pgt

FS: 100



Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.7200	37.06	31.77	45.7	MgO	61.45
Si	KA1	1.740	1.0000	24.56	18.23	26.3	SiO	38.55
Cu	KA1	8.046	0.0000	0.00	0.00	0.0		
O	KA1	0.523	0.0000	38.38	50.00	72.0		
Total			**0.0000**	**100.00**	**100.00**	**144.0**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	11.8	0.5	11.3
Si	KA1	13.4	0.5	12.9
Cu	KA1	56.1	0.9	55.2
O	KA1	0.6	0.5	0.1

Energy Dispersive X-Ray Analysis Quantitative Spectra & Data

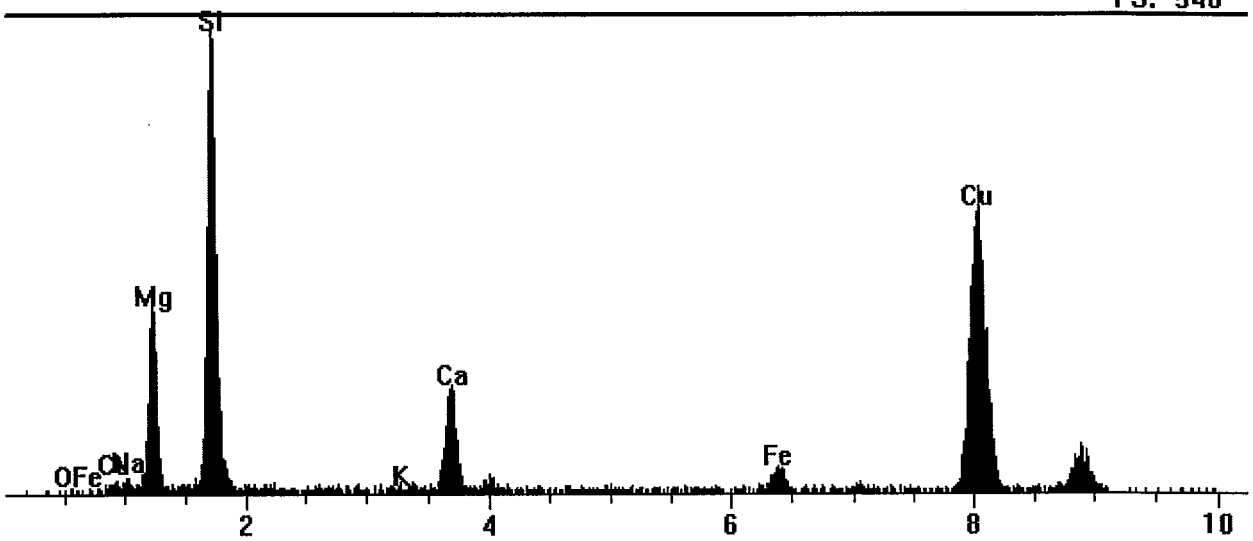
EMSL ANALYTICAL, INC.

File: L:\EDS Spe...pectra\Scope 04-03\2012\091211943-0022 L2 A9 10 AC.pgt
Collected: November 02, 2012 08:17:53

Live Time:	85.17	Count Rate:	428	Dead Time:	8.34 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	27911.44				

091211943-0022 L2 A9 10 AC.pgt

FS: 540



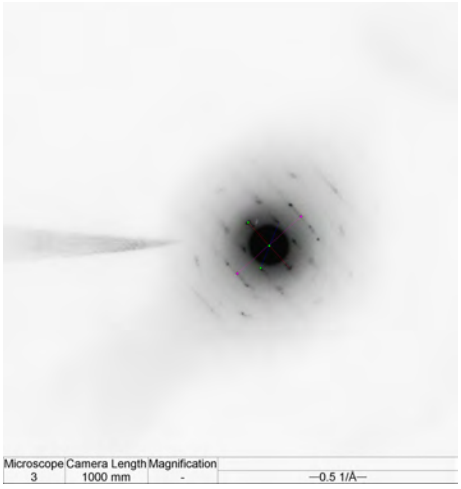
Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.7200	19.05	17.55	25.4	MgO	31.58
Si	KA1	1.740	1.0000	30.96	24.69	35.8	SiO	48.60
K	KA1	3.313	1.2100	0.00	0.00	0.0	K2O	0.00
Ca	KA1	3.691	1.1400	9.50	5.31	7.7	CaO	13.30
Fe	KA1	6.403	1.5300	3.68	1.48	2.1	FeO	4.74
Cu	KA1	8.046	0.0000	0.00	0.00	0.0		
Na	KA1	1.041	2.8100	1.33	1.29	1.9	Na2O	1.79
O	KA1	0.523	0.0000	35.48	49.68	72.0		
Total			**0.0000**	**100.00**	**100.00**	**144.9**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	33.4	1.9	31.5
Si	KA1	90.4	2.2	88.2
K	KA1	1.7	1.7	0.0
Ca	KA1	25.5	1.8	23.7
Fe	KA1	8.4	1.5	6.9
Cu	KA1	99.2	2.1	97.2
Na	KA1	3.0	1.6	1.3
O	KA1	0.7	0.5	0.2

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number:	091211943	**Date:**	Nov 02, 2012
Image Number:	03521		
Reference / Sample Number:	0022		
Preliminary ID:	Chrysotile		
Camera Constant:	1.9493569	**1/A Pixels**	
Calibration Reference:	103112-04-03-03508_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.326**	5.3	**5.06**	**5.56**
Vector Angle:	**59.5**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.338**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.666**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

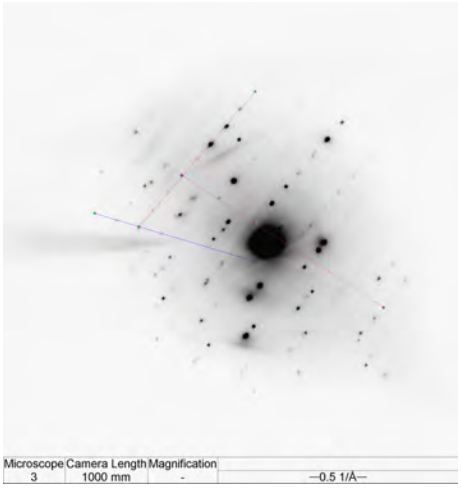
Preliminary Identification was:

X	CORRECT
	INCORRECT

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number:	091211943	**Date:**	Nov 02, 2012
Image Number:	03522		
Reference / Sample Number:	0022		
Preliminary ID:	ACTINOLITE		
Camera Constant:	1.949e-003	**1/A Pixels**	
Calibration Reference:	103112-04-03-03508_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.198**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**5.090**	5.102	**4.847**	**5.357**
d1 or hkl (Camera K/slant vector dist.):	**4.824**	4.882	**4.638**	**5.126**
Ratio of hk0/hkl:	**1.055**	1.045	**0.993**	**1.097**
Vector Angle:	**67.9**	68.030	**64.629**	**71.432**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: [**3 1 2**]

Preliminary Identification was:

X	CORRECT
	INCORRECT

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0023**	Volume (L):	662	Scope:	09-02
Customer Sample:	HM-AP-ATV-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	L, 4-6	Analysis Date:	9/25/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	12	none	3:1	5:1	OVERLOADED
GO Analyzed:	0				28%
Level of Analysis Chrysotile:	CD~~Q~~ 11/21/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0023**	Volume (L):	662	Scope:	04-03
Customer Sample:	HM-AP-ATV-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~ 0.0129 RD 11-15-12
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	P Harrison
EFA (mm^2):	385	Grid Location:	L, 4-6	Analysis Date:	11/6/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	12	none	3:1	5:1	
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/26/12-DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
L4	J8	NSD									
	I4	F	1	1	9.5	0.7	CD	CH		03527	Y
		MD11	2		9.5	6.0					
		MF		2	6.2	0.3	ADX	AC		03528	Y
	G4	NSD									
	A5	F	3	3	17.0	0.7	ADX	AC			
		MD11	4		20.0	15.0					
		MF		4	8.5	0.4	ADX	AC			
	A3	B	5	5	5.7	1.4	CD	CH			
		B	6	6	9.6	1.5	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0023**	Volume (L):	662	Scope:	04-03
Customer Sample:	HM-AP-ATV-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~ 0.0129 RD 11.15.12
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	P Harrison
EFA (mm^2):	385	Grid Location:	L, 4-6	Analysis Date:	11/6/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/6/12 PM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
L5	A2	B	7	7	7.0	0.7	CD	CH			
↓	A5	MD11	8		25.0	15.0					
↓	↓	MB		8	15.8	0.9	CD	CH			
↓	↓	MD11	20		23.0	3.0					
↓	↓	MB	PK 11/6/12	20	17.0	1.5	ARA	NRA		05529	✓
L6	B1	MD11	0		17.0	5.0					
↓	↓	MB		0	14.0	1.2	NRA	NRA			
↓	C6	B	9	9	7.7	0.7	CD	CH			
↓	↓	MD11	10		17.5	7.0					
↓	↓	MF		10	14.0	1.5	ADX	AC			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0023**	Volume (L):	662	Scope:	04-03
Customer Sample:	HM-AP-ATV-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~ 0.0129 RD 11.15.12
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	P Henrison
EFA (mm^2):	385	Grid Location:	L, 4-6	Analysis Date:	11/6/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	12	none	3:1	5:1	
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/2012	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
L6	F~~E~~6	B	0	0	9.5	1.2	CD	Ch			
↓	G1	B	11	11	12.0	2.0	CD	Ch			
↓	H5	NSD									

Energy Dispersive X-Ray Analysis Quantitative Spectra & Data

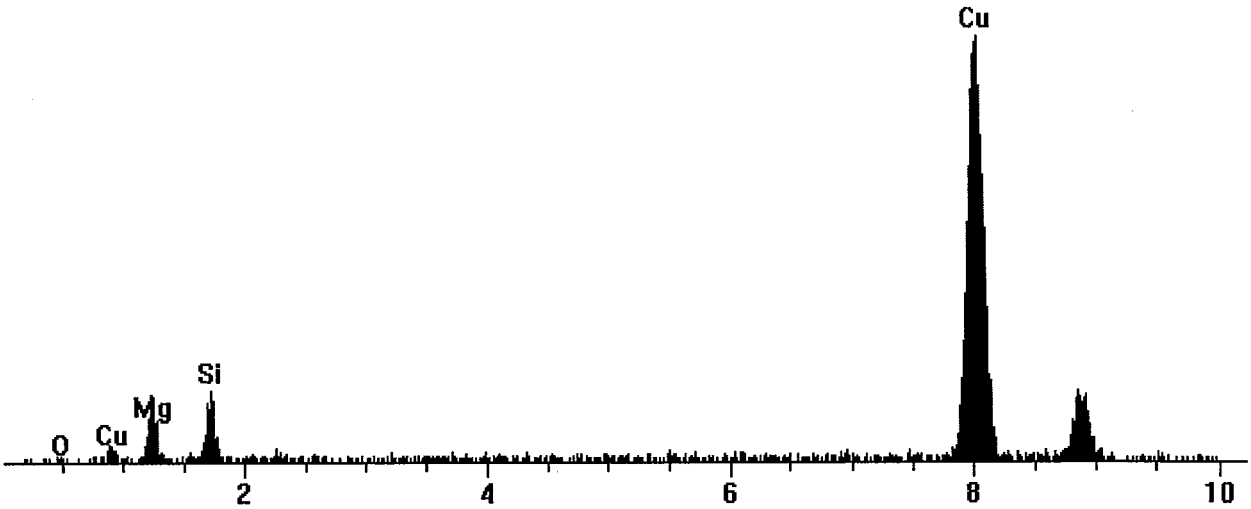
EMSL ANALYTICAL, INC.

File: L:\EDS Spe...Spectra\Scope 04-03\2012\091211943-0023 L4 I4 1 CH.pgt
Collected: Nov 6, 2012 10:58:23

Live Time:	112.65	Count Rate:	96	Dead Time:	2.16 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	54050.18				

■ **091211943-0023 L4 I4 1 CH.pgt**

FS: 225



Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.7200	35.13	30.20	43.5	MgO	58.25
Si	KA1	1.740	1.0000	26.60	19.80	28.5	SiO	41.75
Cu	KA1	8.046	0.0000	0.00	0.00	0.0		
O	KA1	0.523	0.0000	38.27	50.00	72.0		
Total			**0.0000**	**100.00**	**100.00**	**144.0**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	3.3	0.2	3.2
Si	KA1	4.3	0.2	4.1
Cu	KA1	48.8	0.6	48.1
O	KA1	0.2	0.1	0.1

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

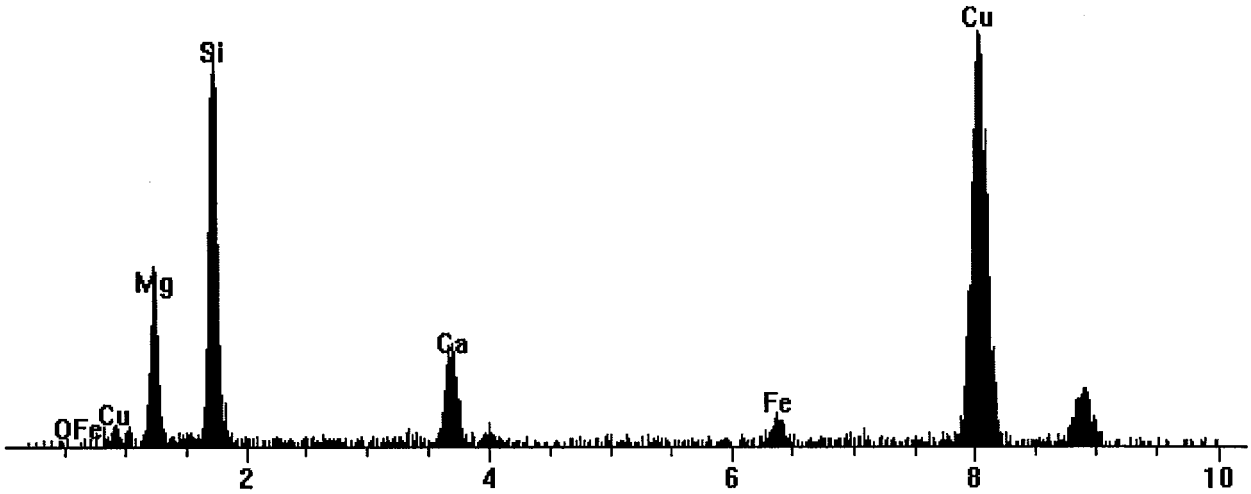
EMSL ANALYTICAL, INC.

File: L:\EDS Spe...Spectra\Scope 04-03\2012\091211943-0023 L4 I4 2 AC.pgt
Collected: November 06, 2012 07:40:32

Live Time:	114.67	Count Rate:	184	Dead Time:	3.78 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	27021.90				

091211943-0023 L4 I4 2 AC.pgt

FS: 280



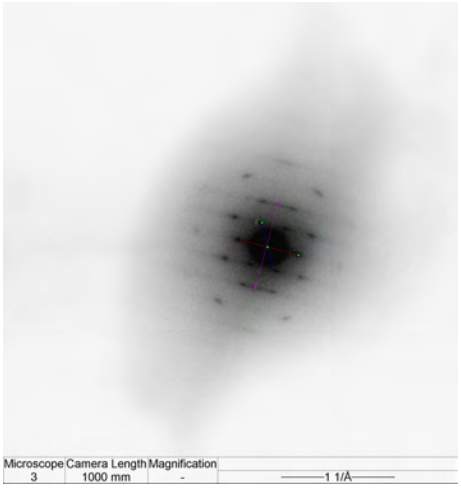
Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.7200	18.74	17.41	25.1	MgO	31.07
Si	KA1	1.740	1.0000	30.78	24.76	35.6	SiO	48.31
Ca	KA1	3.691	1.1400	10.94	6.17	8.9	CaO	15.31
Fe	KA1	6.403	1.5300	4.12	1.67	2.4	FeO	5.30
Cu	KA1	8.046	0.0000	0.00	0.00	0.0		
O	KA1	0.523	0.0000	35.41	50.00	72.0		
Total			**0.0000**	**100.00**	**100.00**	**144.0**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	11.3	0.9	10.4
Si	KA1	30.5	1.0	29.4
Ca	KA1	10.1	0.9	9.2
Fe	KA1	3.1	0.6	2.6
Cu	KA1	55.2	1.2	54.0
O	KA1	0.3	0.1	0.2

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number:	091211943	**Date:**	Nov 06, 2012
Image Number:	03527		
Reference / Sample Number:	0023		
Preliminary ID:	Chrysotile		
Camera Constant:	1.9639471	**1/A Pixels**	
Calibration Reference:	110512-04-03-03523_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.254**	5.3	**5.06**	**5.56**
Vector Angle:	**58.2**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.252**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.645**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

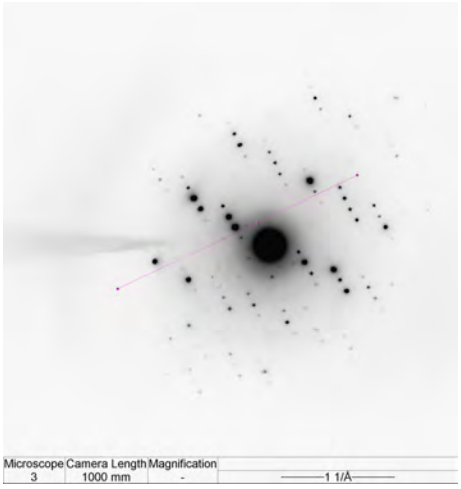
Preliminary Identification was:

X	CORRECT
	INCORRECT

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number:	091211943	**Date:**	Nov 06, 2012
Image Number:	03528		
Reference / Sample Number:	0023		
Preliminary ID:	ACTINOLITE		
Camera Constant:	1.964e-003	**1/A Pixels**	
Calibration Reference:	110512-04-03-03523_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.120**	5.234	**4.972**	**5.496**
d2 or hk0 (Camera K/zero row dist.):	**N/A**	N/A	**-**	**-**
d1 or hkl (Camera K/slant vector dist.):	**N/A**	N/A	**-**	**-**
Ratio of hk0/hkl:	**N/A**	N/A	**-**	**-**
Vector Angle:	**N/A**	N/A	**-**	**-**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: [**N/A**]

Preliminary Identification was:

X	CORRECT
	INCORRECT

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0024**	Volume (L):	792	Scope:	00-02
Customer Sample:	HM-AP-MB-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	M, 1-3	Analysis Date:	9/25/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	10	none	3:1	5:1	
GO Analyzed:	0				OVERLOADED
Level of Analysis Chrysotile:	CD~~Ø~~ 11/26/12 DM	Min Length:	> 5	micron	15%
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected NAM= Non Asbestos Material

ISO 10312

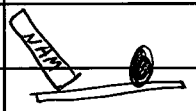
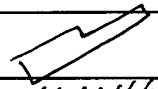
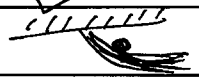
TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0024**	Volume (L):	792	Scope:	04-01
Customer Sample:	HM-AP-MB-01	Prepped By:	PK	GO area (mm2):	~~0.0132~~ 0.0129 RD 11.15.12
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	M, 1-3	Analysis Date:	11/5/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	10		none	3:1	5:1
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:
15% PART. LOADING
VERTICAL TD

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
M1	I5	MD11	1		9	2.5					
		MB		1	9	.5	CD	CH		011345	1
	G4	MD11	2		6.7	.8					
		MF		2	6.7	.3	ADX	ACT		011346	1
	F1	ND									
	D2	MD11	3		6.1	5.5					
		MF		3	6.1	.3	ADX	ACT			
		F	4	4	8.5	1.6	ADX	ACT			
	B4	MD11	0		7.6	1.2					
		MB		0	7.6	.75	CD	CH			

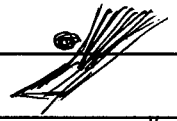
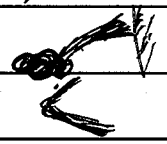
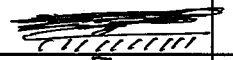
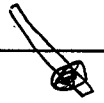
ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0024**	Volume (L):	792	Scope:	04-01
Customer Sample:	HM-AP-MB-01	Prepped By:	PK	GO area (mm2):	~~0.0132~~ 0.0129 RD 11.15.12
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	M, 1-3	Analysis Date:	11/5/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	10	none	3:1	5:1	15% PART. LOADING
GO Analyzed:	10				VERTICAL TD
Level of Analysis Chrysotile:	CDØ / ilbaln. om	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	≥ 0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
M1	B4	MD11	5		7.8	3.2					
		MB		5	7.8	3.1	CD	CH			
		MC11	6	6	5.6	7.5	CD	CH			
M2	B3	B	7	7	6.3	.5	CD	CH			
		B	8	8	11.5	1.25	CD	CH			
	D5	F	9	9	8.5	1.6	ADX	ACT			
	F2	ND									
	H4	ND									
	J3	MD11	10		9.1	1.7					
		MF		10	9.1	1.2	ADX	ACT			

ISO 10312

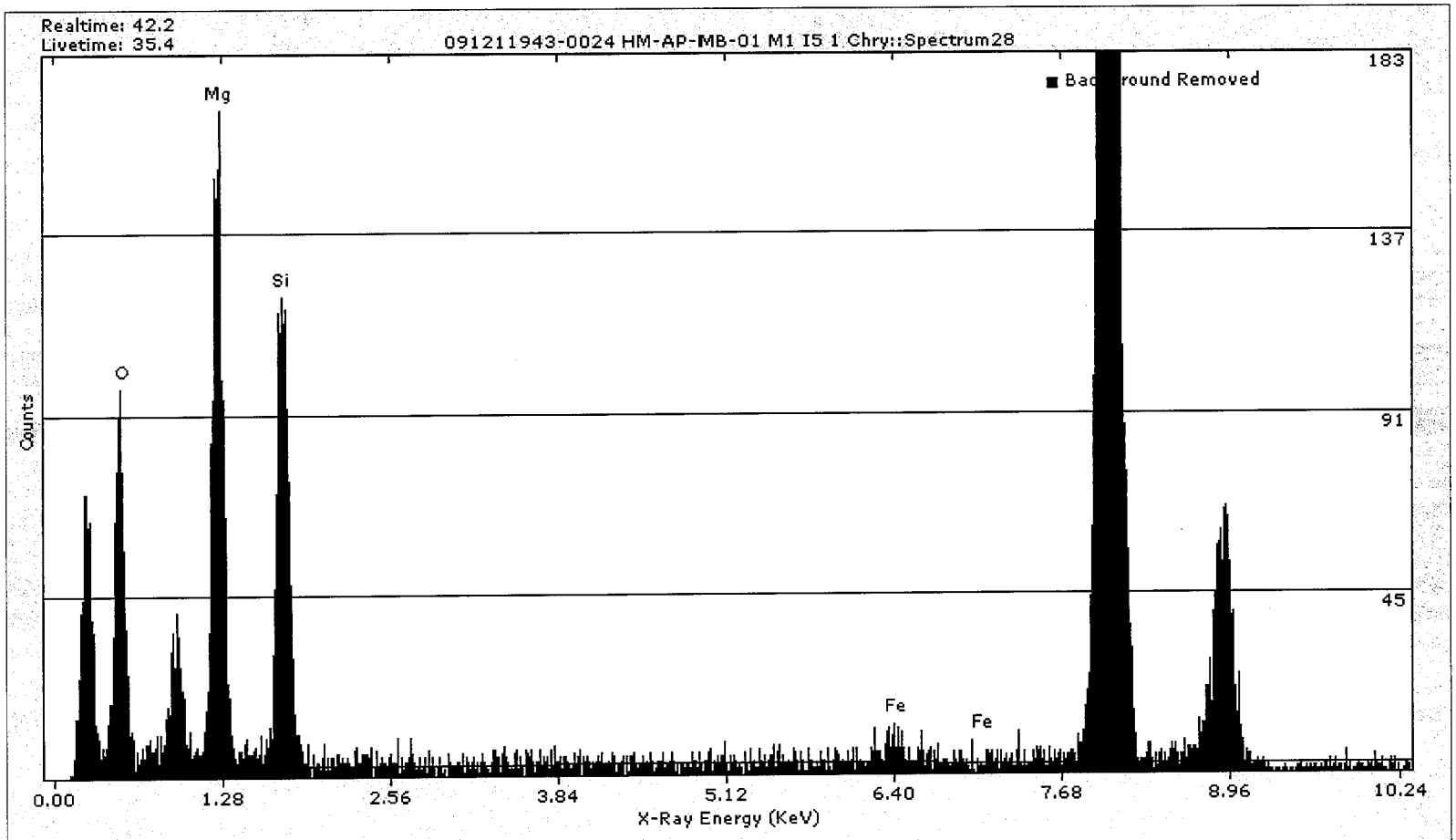
TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0024**	Volume (L):	792	Scope:	04-01
Customer Sample:	HM-AP-MB-01	Prepped By:	PK	GO area (mm2):	~~0.0132~~ 0.0129 RD 11.15.12
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	M, 1-3	Analysis Date:	11/5/12

Analysis Information

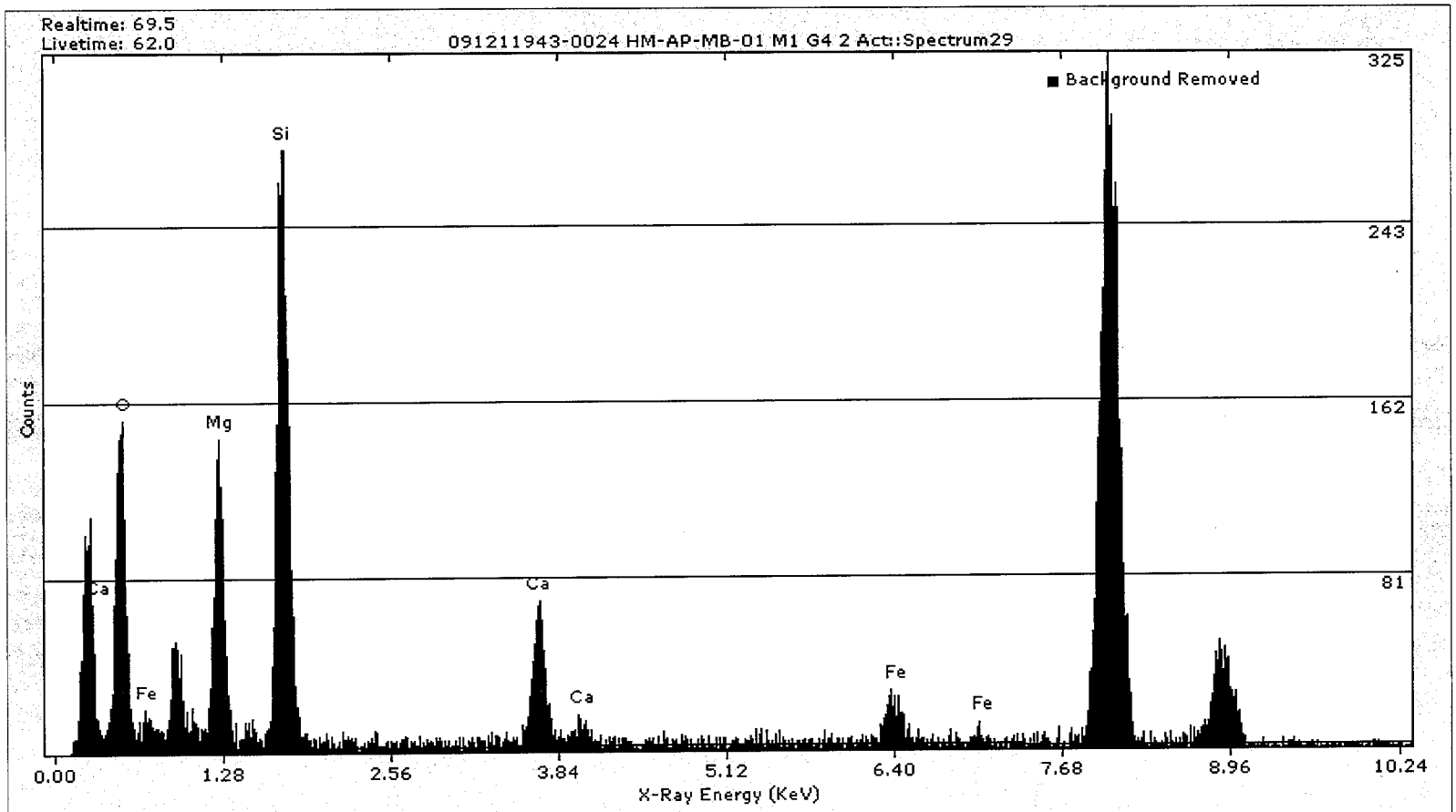
Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:** 15% PART. LOADING VERTICAL TD
GO Required:	10	none	3:1	5:1	
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD~~Q~~ 11/29/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	≥ 0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
M2	J3	F	11	11	6	.8	ADX	ACT			



Quantitative Results for Spectrum28
Analysis: Thin Film Method: Standardless
Acquired 05-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	45.78	1.95	57.81	0.00		0.0000	0.0	85.8	691.31
Magnesium	31.52	0.90	26.21	52.28	(MgO)	0.4002	1214.6	95.5	1222.84
Silicon	21.72	0.69	15.62	46.46	(SiO2)	0.2618	977.9	101.4	1032.46
Iron	0.98	0.03	0.35	1.26	(FeO)	0.0087	36.4	146.1	78.90
Total	100.00			100.00					



Quantitative Results for Spectrum29
Analysis: Thin Film Method: Standardless
Acquired 05-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.29	1.60	60.82	0.00		0.0000	0.0	85.8	1155.08
Magnesium	14.67	0.31	12.69	24.33	(MgO)	0.2081	972.3	95.6	1009.51
Silicon	28.90	0.61	21.63	61.82	(SiO2)	0.3844	2232.7	101.4	2327.86
Calcium	7.05	0.15	3.70	9.87	(CaO)	0.0540	566.8	122.2	611.94
Iron	3.09	0.07	1.16	3.97	(FeO)	0.0219	197.0	146.0	252.46
Total	100.00			100.00					

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 05, 2012

Image Number: 011345

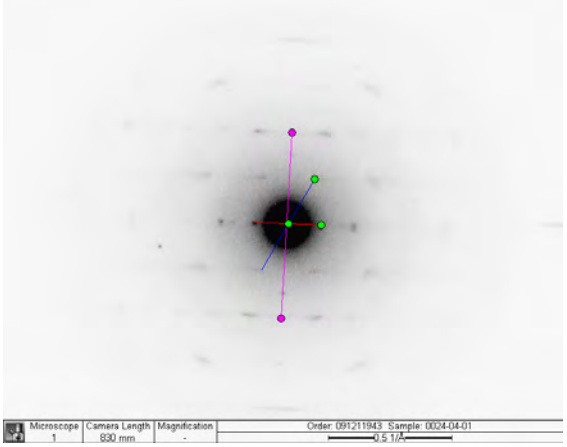
Reference / Sample Number: 0024

Preliminary ID: Chrysotile

Camera Constant: 2.964e-003 **1/A Pixels**

Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.283**	5.3	**5.06**	**5.56**
Vector Angle:	**62.2**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.327**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.661**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 05, 2012

Image Number: 011346

Sample Number: 0024-04-01

Preliminary ID: Actinolite

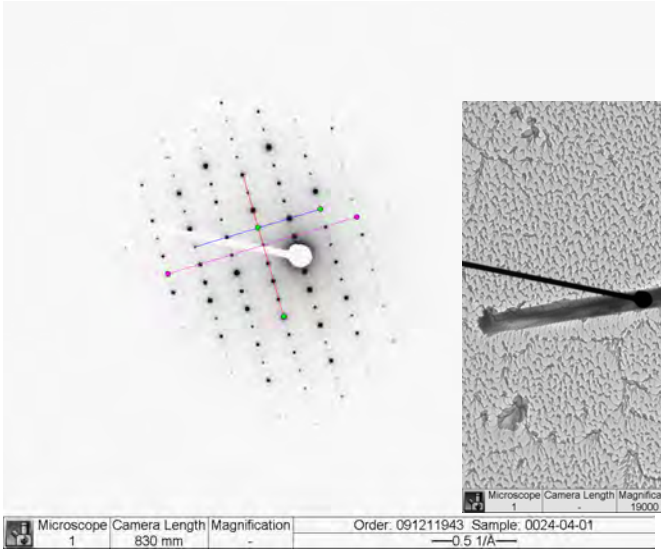
Camera Constant: 2.964e-003 **1/A Pixels**

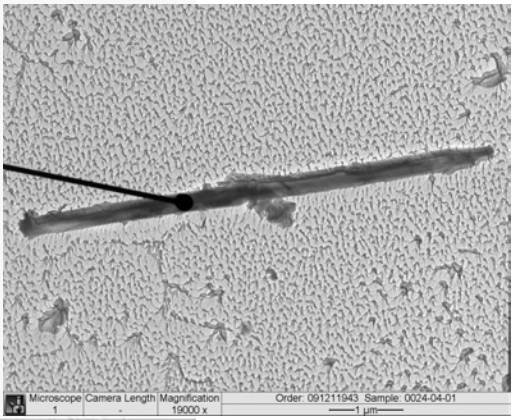
Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.127**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**9.160**	9.055	**8.602**	**9.508**
d1 or hkl (Camera K/slant vector dist.):	**5.145**	5.158	**4.900**	**5.416**
Ratio of hk0/hkl:	**1.780**	1.756	**1.668**	**1.844**
Vector Angle:	**89.5**	90.000	**85.500**	**94.500**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: [**1 0 0**]





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By:

F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0025**	Volume (L):	786	Scope:	09-02
Customer Sample:	HM-AP-MB-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	M, 4-6	Analysis Date:	9/25/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	10	none	3:1	5:1	
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD~~Q~~ libulin dym	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
M4	E10	B	1	1	5.5	1.1	CD	CHRYS		43901	
M4	E8	B	2	2	5.1	0.55	CDQ	CHRYS			YES
M4	E8	B	3	3	6.8	0.9	CD	CHRYS			
M4	E8	B	4	4	7.2	0.95	CD	CHRYS			
M4	E6	B	5	5	12.2	2.8	CD	CHRYS			
M4	E4	B	6	6	8.4	2.3	CD	CHRYS			
M4	E4	B	7	7	5.6	0.8	CD	CHRYS			
M4	D10	B	~~8~~ 0	~~8~~ 0	2.8	0.6	CD	CHRYS			
M4	D10	B	8 ~~9~~	8 ~~9~~	41.2	1	CD	CHRYS			
M5	D10	B	9 ~~10~~	9 ~~10~~	10.2	2.5	CD	CHRYS			

ISO 10312

091211943-0025

TEM Asbestos Count Sheet

M5	D8	B	10 ~~11~~	10 ~~11~~	11.6	2.8	CD	CHRYS			
M5	D8	B	11 ~~12~~	11 ~~12~~	8.6	1.4	CD	CHRYS			
M5	D8	B	12 ~~13~~	12 ~~13~~	26.4	4.2	CD	CHRYS			
M5	D6	B	13 ~~14~~	13 ~~14~~	6.4	1.3	CD	CHRYS			
M5	D6	B	14 ~~15~~	14 ~~15~~	9.2	2.6	CD	CHRYS			
M5	D6	B	15 ~~16~~	15 ~~16~~	6.3	1.4	CD	CHRYS			
M5	D6	B	16 ~~17~~	16 ~~17~~	5	0.5	CD	CHRYS			
M6	E10	ND									
M6	E8	B	17 ~~18~~	17 ~~18~~	18.95	1.25	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

11/21/12 DM

TEM ISO 10312

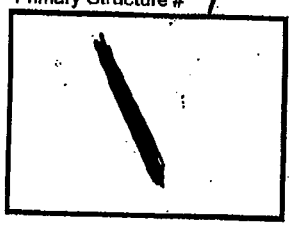
Structure Sketch Sheet

EMSL Order ID: 0912 1943-0025 Client:

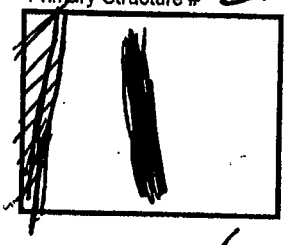
Client Sample:

Page 1 of 1

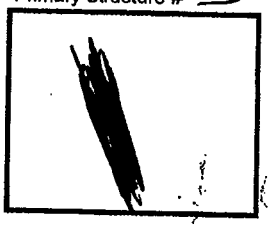
Primary Structure # 1



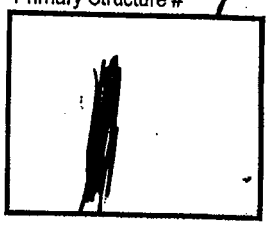
Primary Structure # 2



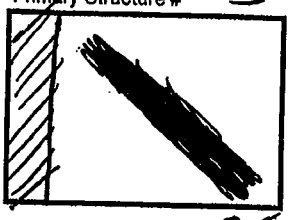
Primary Structure # 3



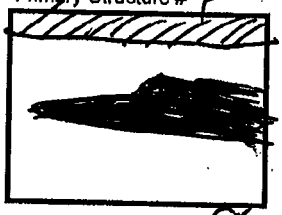
Primary Structure # 4



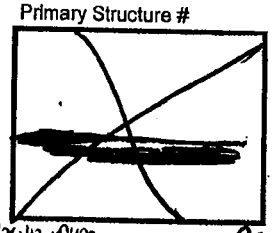
Primary Structure # 5



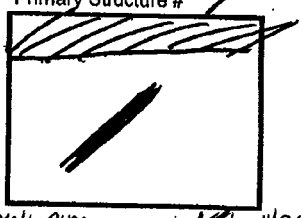
Primary Structure # 6



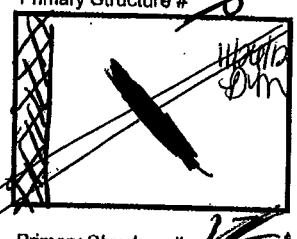
Primary Structure #



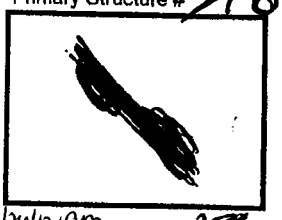
Primary Structure # 7



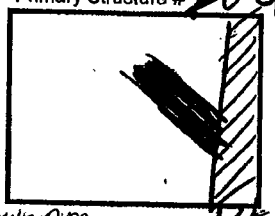
Primary Structure # ~~8~~



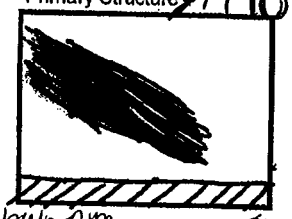
Primary Structure # ~~9~~ 8



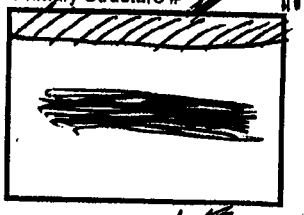
Primary Structure # ~~10~~ 9



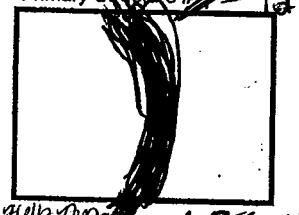
Primary Structure # ~~11~~ 10



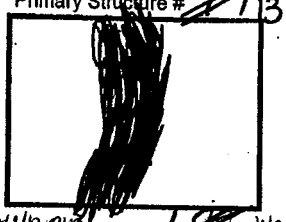
Primary Structure # ~~12~~ 11



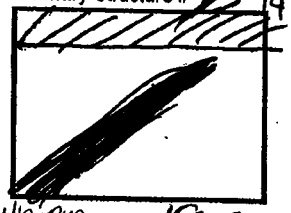
Primary Structure # ~~13~~ 12



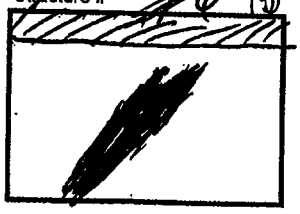
Primary Structure # ~~14~~ 13



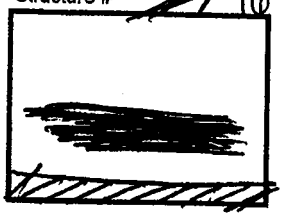
Primary Structure # ~~15~~ 14



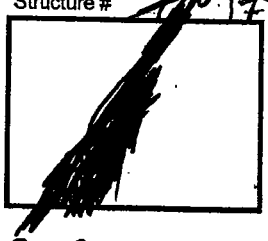
Structure # ~~16~~ 15



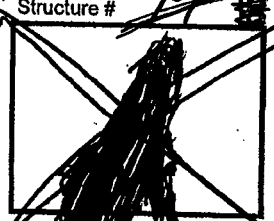
Structure # ~~17~~ 16



Structure # ~~18~~ 17



Structure # ~~19~~ 18



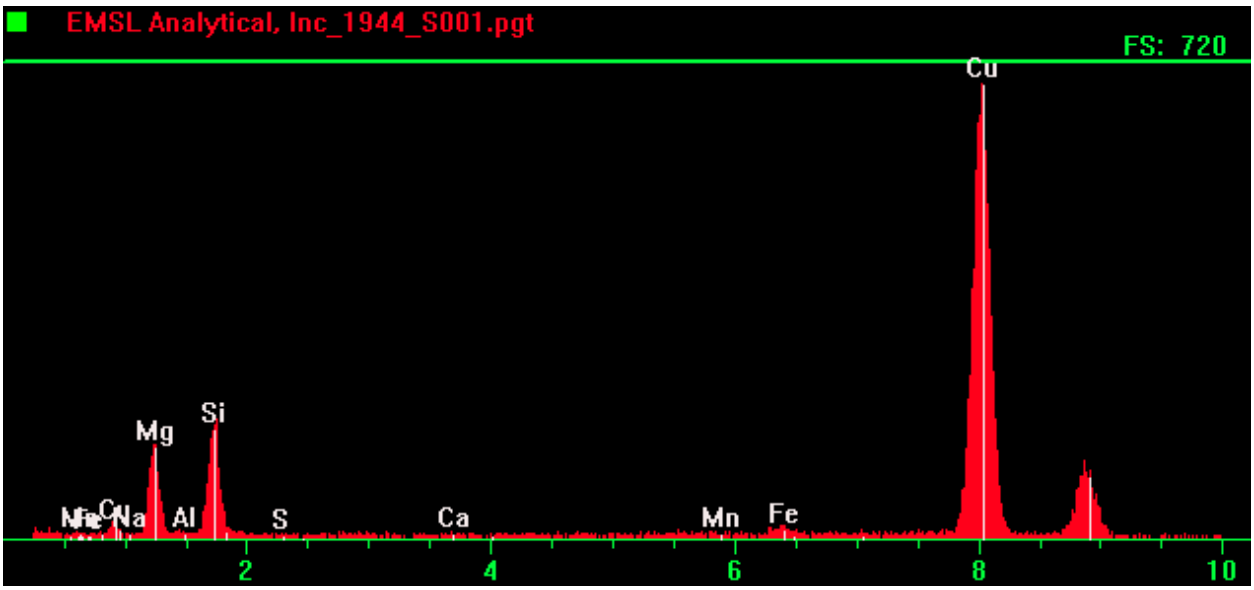
Analyst: KD Date: 25 SEPT 12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0025_TEM_ISO_10312_EDX_Chrysotile
Collected: September 25, 2012 17:51:24

Live Time:	48.99	Count Rate:	931	Dead Time:	11.89 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.0	3.3	0.0	0.0
Mg	KA1	51.4	3.4	47.9	14.0
Al	KA1	4.4	3.6	0.8	0.2
Si	KA1	65.2	3.1	62.1	19.9
S	KA1	3.1	2.6	0.5	0.2
Ca	KA1	3.5	2.5	1.0	0.4
Mn	KA1	4.5	3.7	0.8	0.2
Fe	KA1	10.2	4.4	5.8	1.3
Cu	KA1	407.1	4.8	402.3	83.9

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/02/12

Indexing of negative number: 43901 SCOPE #: 2

Reference / Sample Number: 0025

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.49 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.25	mm

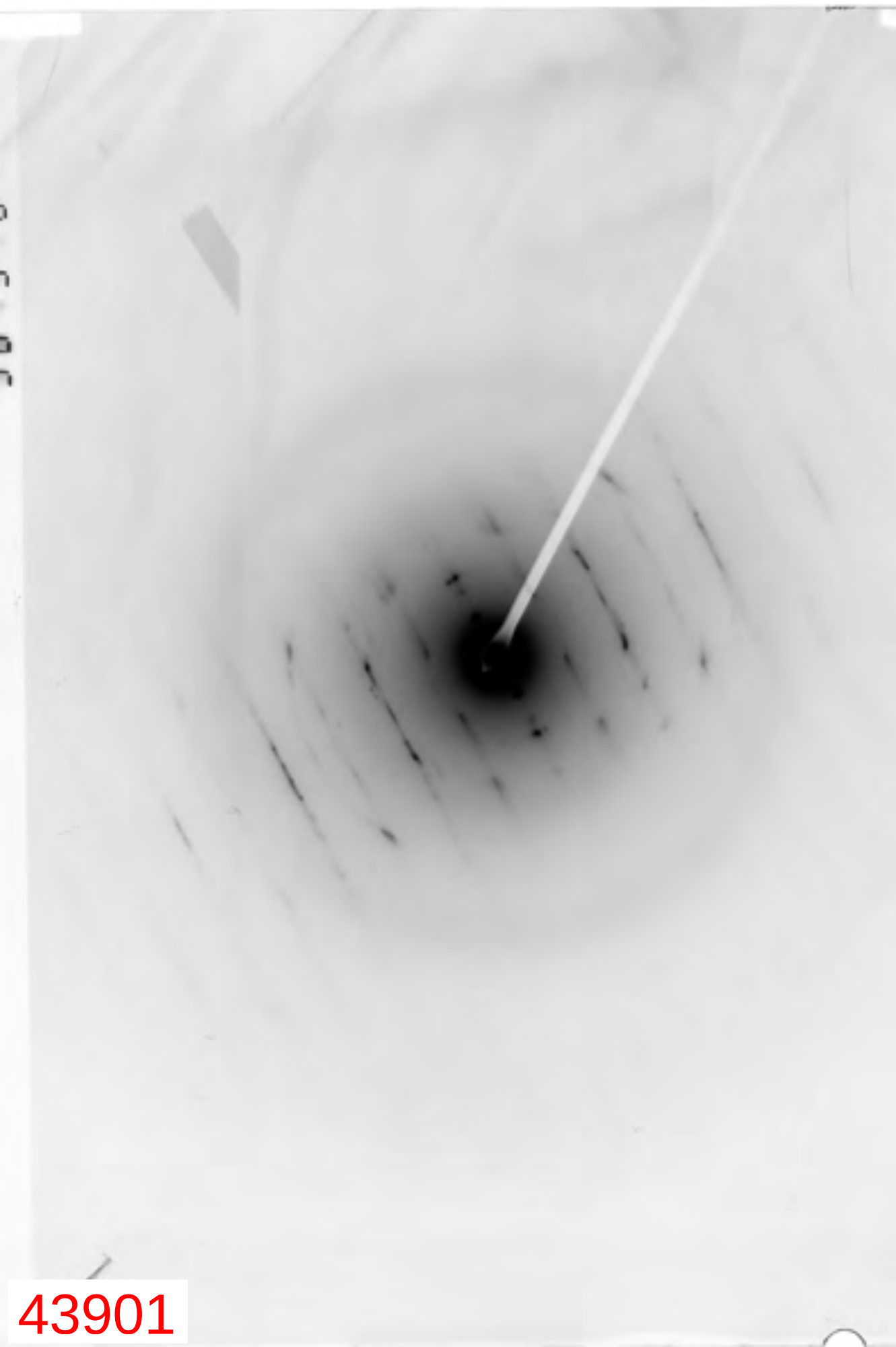
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.33**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.56**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43901

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0026**	Volume (L):	730	Scope:	09-02
Customer Sample:	HM-AP-MB-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	N, 1-3	Analysis Date:	9/26/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CDQ illbulr DIM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
N1	H10	B	1	1	6	0.8	CDQ	CHRYS		44017	YES
N1	H8	ND									
N1	H4	ND									
N1	H2	B	2	2	9.8	1.1	CD	CHRYS			
N2	G1	B	3	3	13	3.4	CD	CHRYS			
N2	G3	B	4	4	18.4	1.5	CD	CHRYS			
N2	G5	B	5	5	7.4	1.1	CD	CHRYS			
N2	G5	B	6	6	7.1	1.4	CD	CHRYS			
N2	G5	B	7	7	20.3	1.8	CD	CHRYS			
N2	G5	B	8	8	17	3	CD	CHRYS			

ISO 10312

09121943-0026

TEM Asbestos Count Sheet

N2	G7	MD11	9		8.4	2.5	CD	CHRYS			
N2	G7	MB		9	5.5	1	CD	CHRYS			
N2	G7	B	10	10	5.6	1.1	CD	CHRYS			
N3	E10	B	11	11	10.8	1..8	CD	CHRYS			
N3	E10	B	12	12	11.2	2.1	CD	CHRYS			
N3	E10	B	13	13	9.9	0.45	CD	ACTINOLITE		44018	YES
N3	E8	ND									
N3	E6	B	14	14	21.2	6.1	CD	CHRYS			
N3	E6	B	15	15	9.7	3.2	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

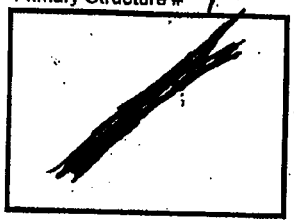
Structure Sketch Sheet

EMSL Order ID: 0912 1943-0026 **Client:**

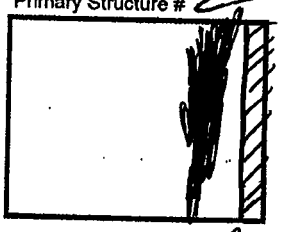
Client Sample:

Page 1 of 1

Primary Structure # 1



Primary Structure # 2



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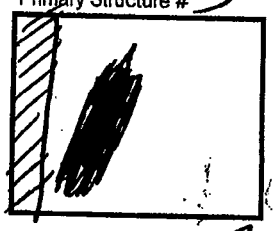

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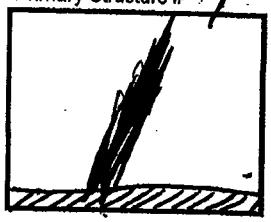

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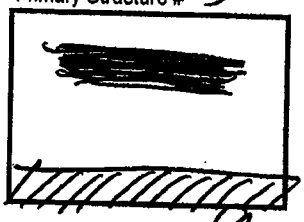
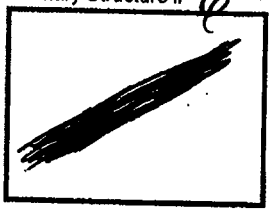
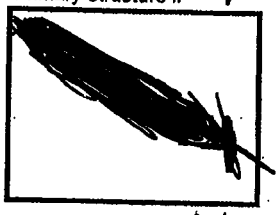


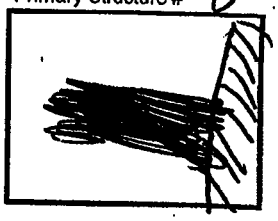
Primary Structure # 6



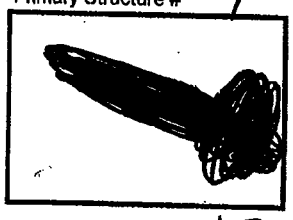
Primary Structure # 7



Primary Structure # 8



Primary Structure # 9



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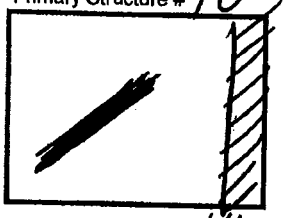
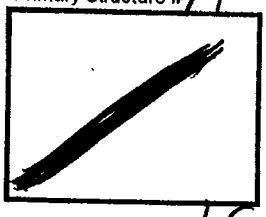
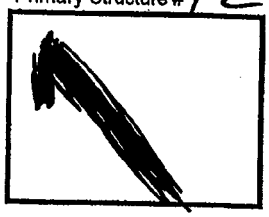


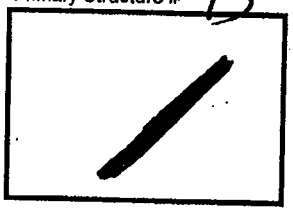
Primary Structure # 11



Primary Structure # 12



Primary Structure # 13



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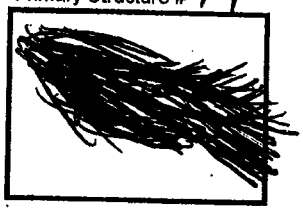
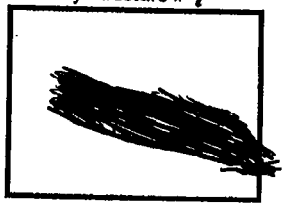


Primary Structure # 15



Primary Structure #

Structure #

Structure #

Structure #

Structure #

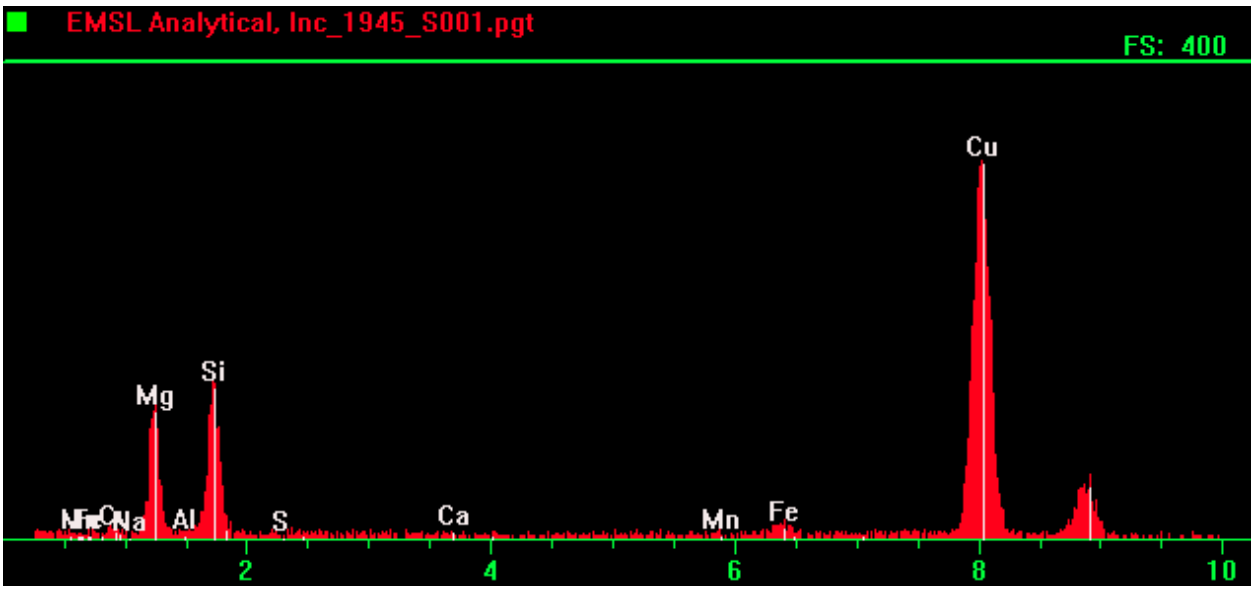
Analyst: KD Date: 26 Sept 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0026_TEM_ISO_10312_EDX_Chrysotile
Collected: September 26, 2012 11:50:52

Live Time:	30.92	Count Rate:	793	Dead Time:	10.06 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



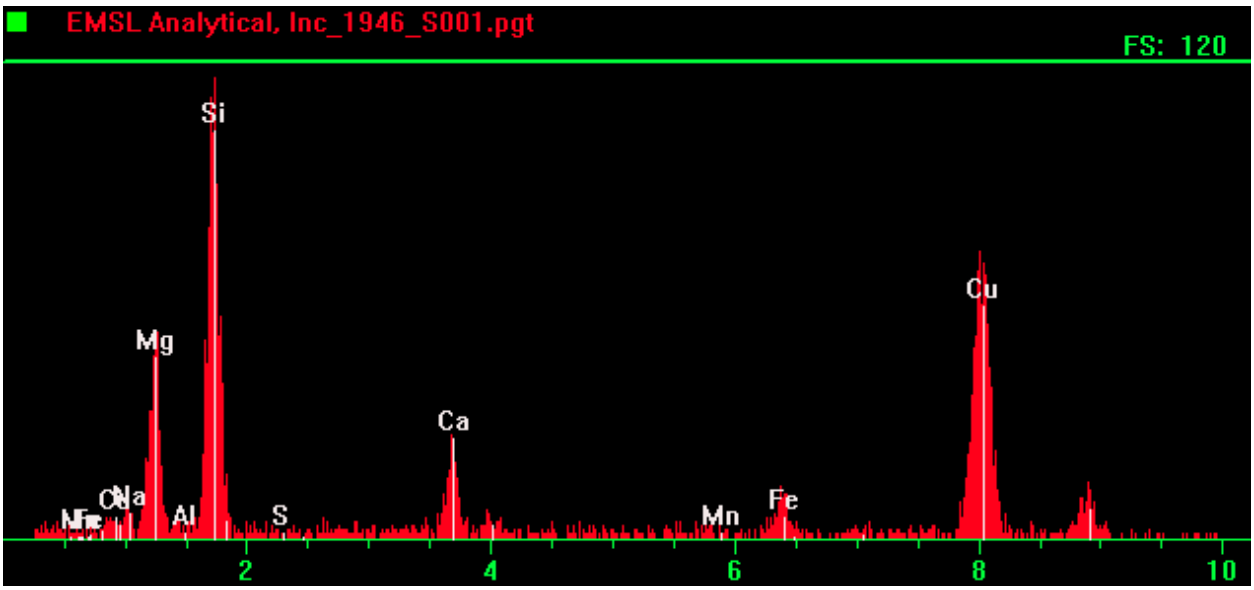
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	2.7	3.1	0.0	0.0
Mg	KA1	63.6	3.1	60.5	19.5
Al	KA1	4.2	3.2	1.0	0.3
Si	KA1	84.8	3.2	81.6	25.2
S	KA1	2.9	2.6	0.3	0.1
Ca	KA1	3.2	2.0	1.2	0.6
Mn	KA1	3.7	2.4	1.3	0.5
Fe	KA1	11.2	3.5	7.6	2.2
Cu	KA1	297.4	3.8	293.6	77.6

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0026_TEM_ISO_10312_EDX_Actinolite
Collected: September 26, 2012 15:08:51

Live Time:	64.70	Count Rate:	151	Dead Time:	2.18 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	1.5	1.1	0.3	0.2
Mg	KA1	12.3	1.1	11.2	10.0
Al	KA1	1.2	1.2	0.0	0.0
Si	KA1	32.2	0.9	31.3	36.9
S	KA1	0.7	0.4	0.3	0.7
Ca	KA1	7.1	0.5	6.6	13.9
Mn	KA1	0.8	0.6	0.3	0.5
Fe	KA1	4.4	0.6	3.8	6.9
Cu	KA1	32.7	0.6	32.1	53.2

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 44017 SCOPE #: 2

Reference / Sample Number: 26

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

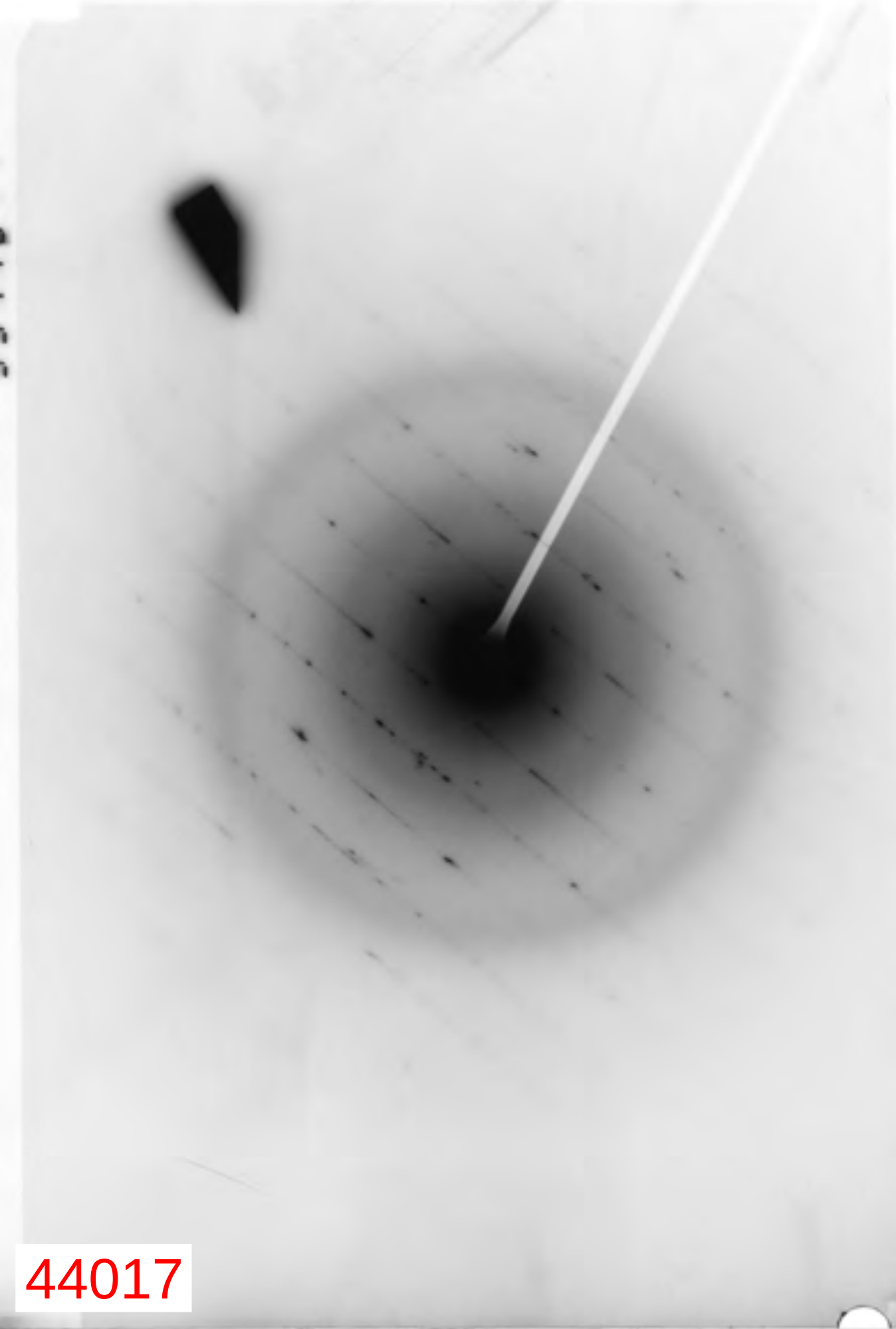
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



44017

EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 44018 SCOPE # 2

Reference / Sample Number: 26

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.55 mm
Mean Distance between spots on Center row (d2): 4.69 mm
Mean distance between spots on slant vector (d1): 5.9 mm

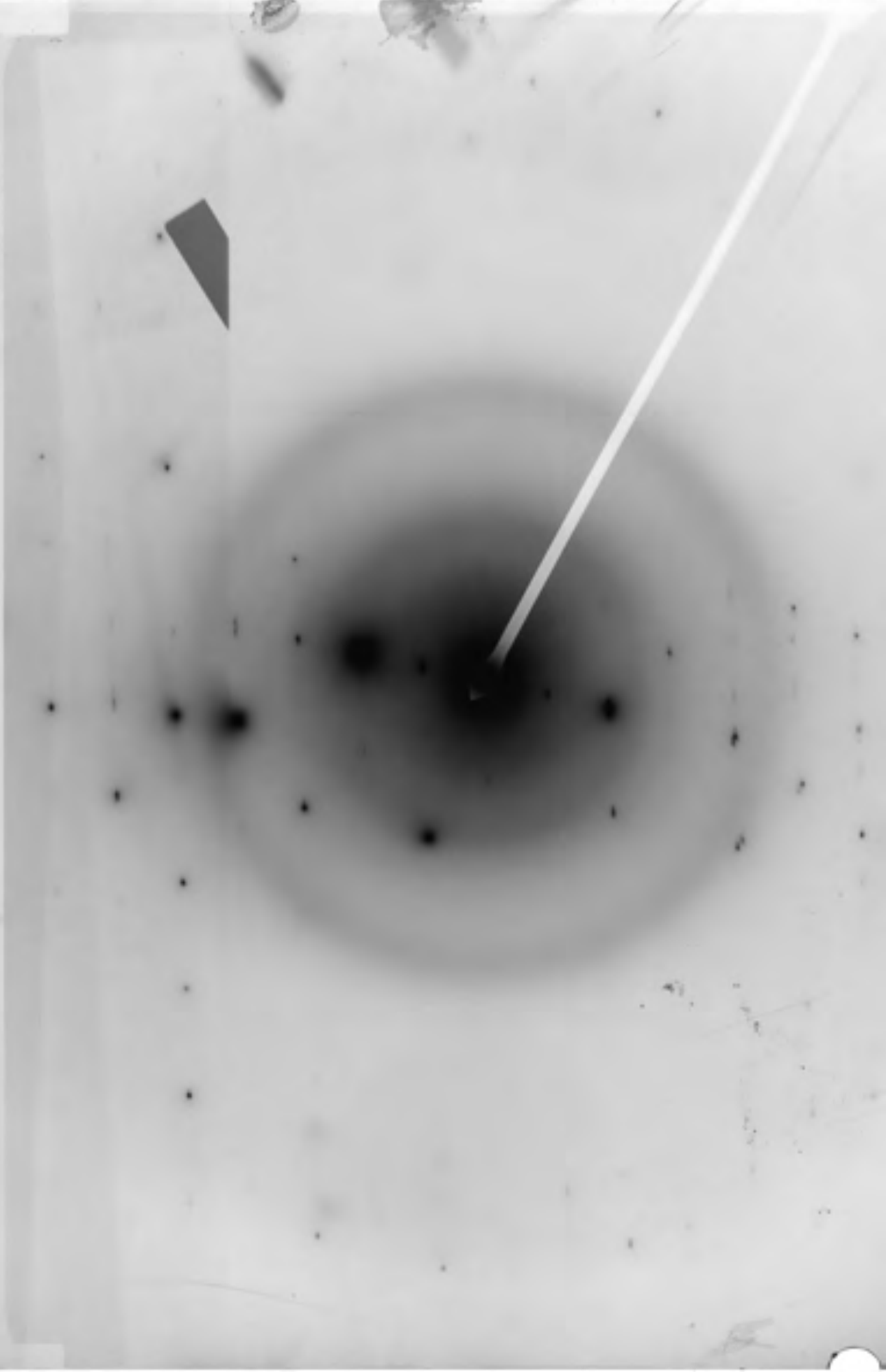
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.25**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**5.09**	5.099	**4.844**	**5.354**
d1 or hk1 (Camera K/slant vector dist.)	**4.05**	3.907	**3.712**	**4.102**
Ratio of hk0/hk1	**1.26**	1.31	**1.245**	**1.376**
Angle of Slant Vector (Measured)	50.0	48.6	**46.170**	**51.030**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [3 -1 0]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0027**	Volume (L):	705	Scope:	09-02
Customer Sample:	HM-AP-MB-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	~~8~~ Air ilhalp-vm	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	N, 4-6	Analysis Date:	9/26/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ ilhalp		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
N4	H1	B	1	1	7.4	1.8	CD	CHRYS			
N4	H1	B	2	2	5.1	0.3	CD	CHRYS			
N4	H3	CC+0	3	3	5.7	0.5	CD	CHRYS			ilhalp-vm
N4	H3	B	4	4	6	1.2	CDQ	CHRYS		3 ~~4~~6905	YES
N4	H5	B	5	5	14.1	0.25	CD	CHRYS			
N4	H7	B	6	6	15.8	4.5	CD	CHRYS			
N4	I9	CC+0	7	7	10.1	3	CD	CHRYS			
N5	F3	B	8	8	12.2	2.1	CD	CHRYS			
N5	F5	B	9	9	15.65	0.35	CD	CHRYS			
N5	F5	B	10	10	9.1	2	CD	CHRYS			

09121 1943-0027

ISO 10312

TEM Asbestos Count Sheet

N5	E10	B	11	11	5.5	1.1	CD	CHRYS			
N5	E10	B	12	12	11.2	3.3	CD	CHRYS			
N6	H10	ND									
N6	H8	B	13	13	24.6	7.6	CD	CHRYS			
N6	H6	B	14	14	10.9	1.4	CD	CHRYS			
N6	H6	B	15	15	7.1	2.3	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

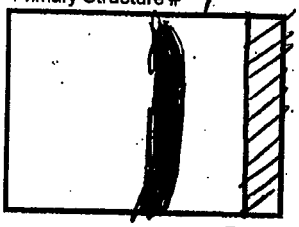
Structure Sketch Sheet

EMSL Order ID: 0912119413-0027 **Client:**

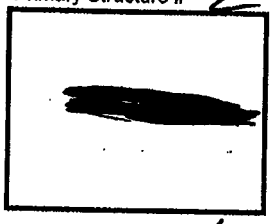
Client Sample:

Page 1 of 1

Primary Structure # 1



Primary Structure # 2



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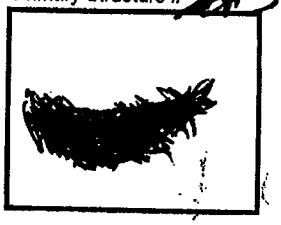
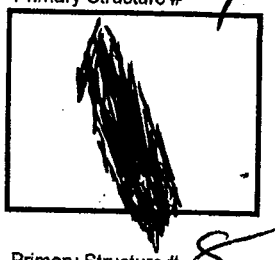
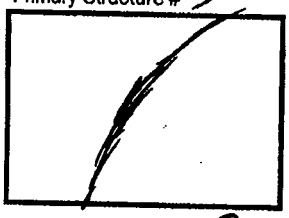


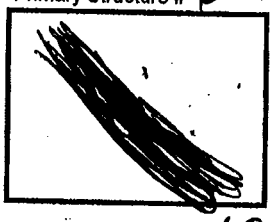
Primary Structure # 4



Primary Structure # 5

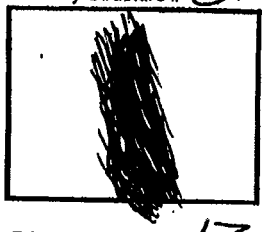


Primary Structure # 6



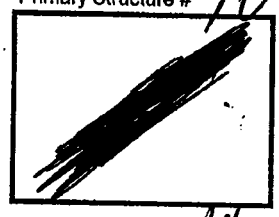
Primary Structure # 7

Primary Structure # 8

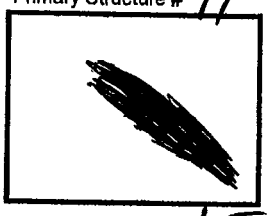


Primary Structure # 9

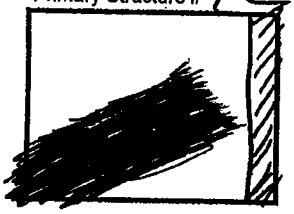
Primary Structure # 10



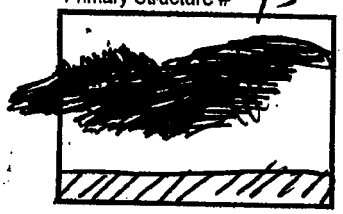
Primary Structure # 11



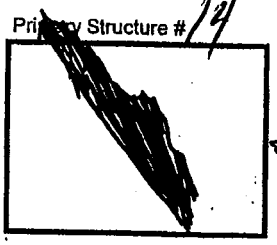
Primary Structure # 12



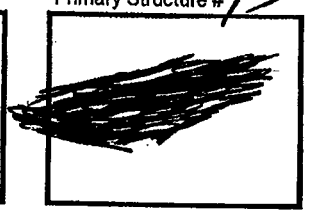
Primary Structure # 13



Primary Structure # 14



Primary Structure # 15



Primary Structure #

Structure #

Structure #

Structure #

Structure #

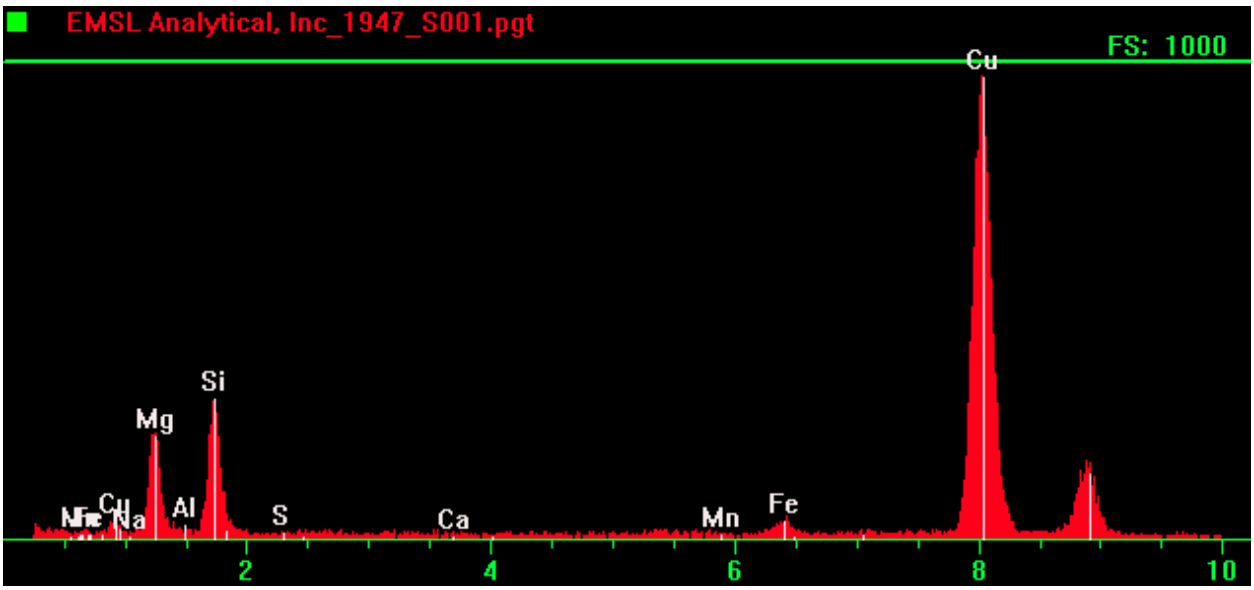
Analyst: KD Date: 27SEPT12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0027_TEM_ISO_10312_EDX_Chrysotile
Collected: September 26, 2012 17:22:18

Live Time:	31.51	Count Rate:	2373	Dead Time:	29.03 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	9.1	10.1	0.0	0.0
Mg	KA1	132.8	11.4	121.3	10.6
Al	KA1	15.3	11.9	3.4	0.3
Si	KA1	181.6	11.5	170.2	14.9
S	KA1	9.1	9.4	0.0	0.0
Ca	KA1	9.6	7.9	1.8	0.2
Mn	KA1	12.2	11.4	0.8	0.1
Fe	KA1	35.4	11.4	23.9	2.1
Cu	KA1	898.6	13.6	885.0	65.0

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/02/12

Indexing of negative number: 43905 SCOPE #: 2

Reference / Sample Number: 0027

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.45 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.00	mm

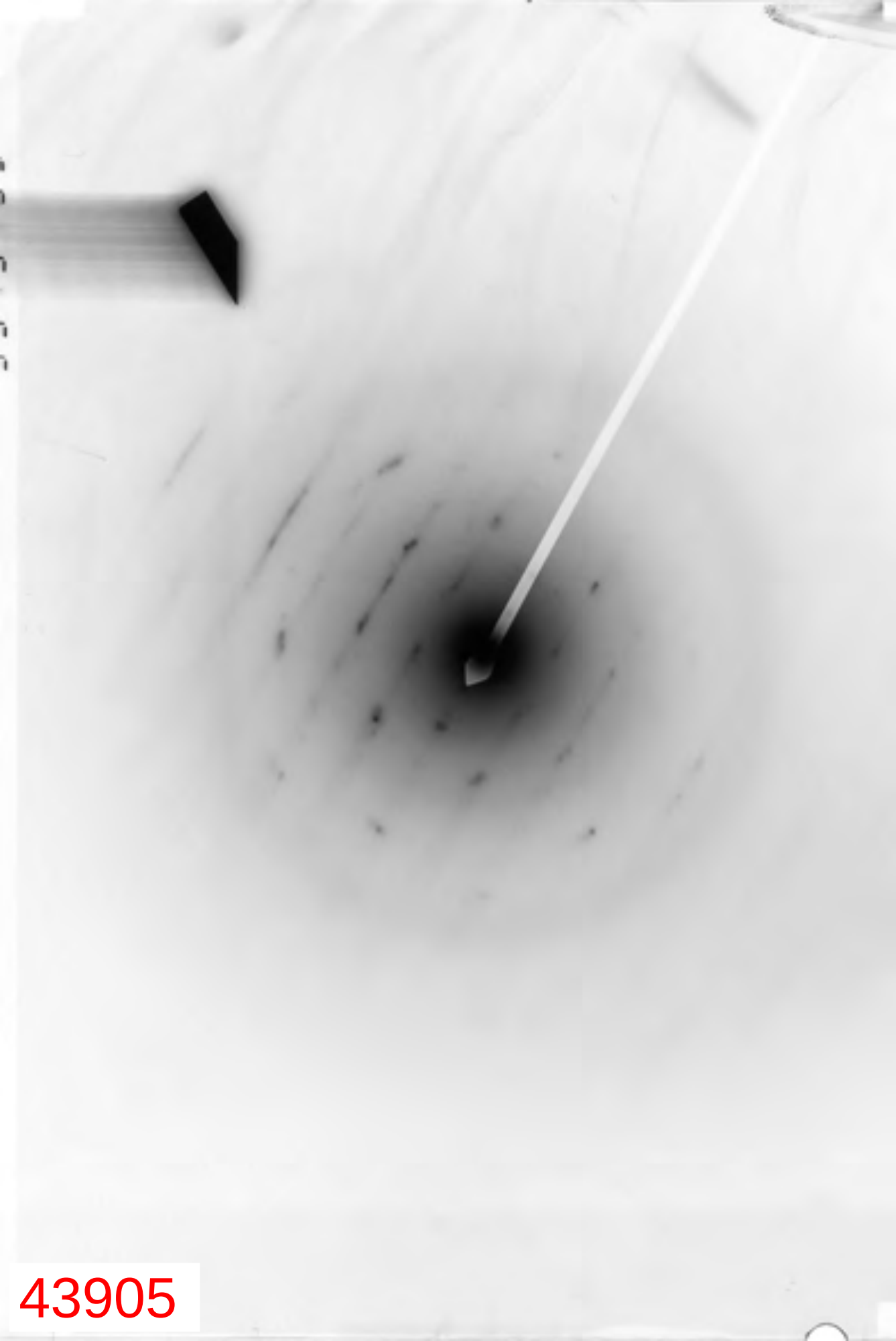
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.38**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.79**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43905

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0028**	Volume (L):	600	Scope:	09-02
Customer Sample:	HM-AP-MB-05	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	O, 4-6	Analysis Date:	9/27/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	~~13~~ 14 11/27/12 DM		none	3:1	5:1
GO Analyzed:	~~14~~ 14				
Level of Analysis Chrysotile:	CD~~Q~~ 11/27/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
O4	G10	B	1	~~3~~ 1 11/27/12 DM	27.1	1.5	ADX	Actinolite		44019	YES
O4	G10	B	2	2	5.2	1	ADX	Actinolite			
O4	G8	ND									
O4	G6	B	3	3	11.2	2	CD	CHRYS		43908	Yes
O4	G4	B	4	4	7.8	2	CD	CHRYS			
O4	G4	B	5	5	10.6	2.3	CD	CHRYS			
O4	G4	MD11	6		11.8	2.1	CD	CHRYS			
O4	G4	MB		6	11.8	0.9	CD	CHRYS			
O4	G4	B	7	7	6.4	0.55	CD	CHRYS			
O4	G1	MD11	8		8.3	4.1	CD	CHRYS			

091211943-0028

ISO 10312

TEM Asbestos Count Sheet

O4	G1	MB		8	7.3	0.25	CD	CHRYS			
O4	G1	B	9	9	6.6	2	CD	CHRYS			
O4	G1	B	10	10	11	0.5	CD	CHRYS			
O4	G1	B	11	11	6.8	1.2	CD	CHRYS			
O4	F1	ND									
O4	F1	B	12	12	6.5	1.6	CD	CHRYS			
O5	F3	ND									
O5	F5	B	13	13	10.05	2	CD	CHRYS			
O5	F5	B	14	14	8.9	0.45	CD	CHRYS			
O5	F7	ND									
O5	J7	MD11	15		9.8	2.1	CD	CHRYS			
O5	J7	MB		15	7.15	0.35	CD	CHRYS			
O5	J7	B	16	16	16.75	2.1	ADX	Actinolite			
O6	E10	MD11	17		25.15	3.5	CD	CHRYS			
O6	E10	MB		17	25.15	1.05	CD	CHRYS			
O6	E8	B	18	18	8	1.35	CD	CHRYS			
O6	E6	B	19	19	5.8	0.35	CD	CHRYS			
O6	E4	ND									

ND= None Detected

NAM= Non Asbestos Material

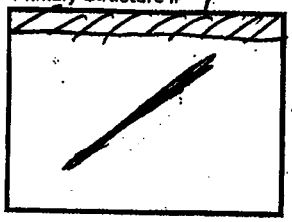
TEM ISO 10312

Structure Sketch Sheet

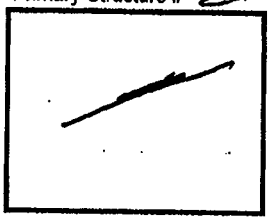
EMSL Order ID: 0912119413-0028 **Client:**

Client Sample: _____ Page 1 of 1

Primary Structure # 1



Primary Structure # 2



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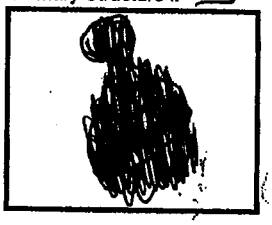

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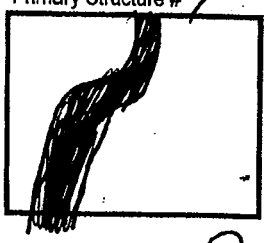

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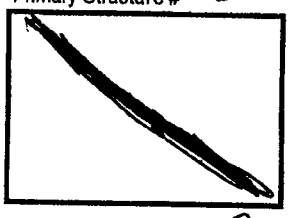

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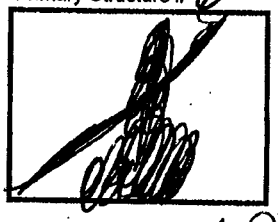

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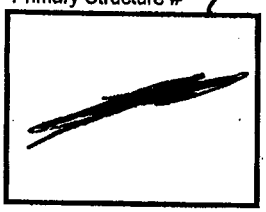
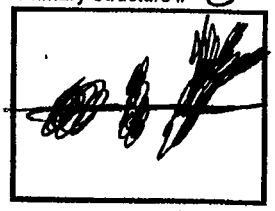


Primary Structure # 8



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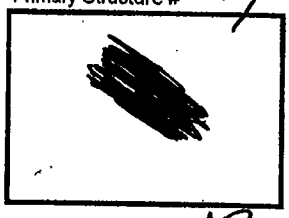

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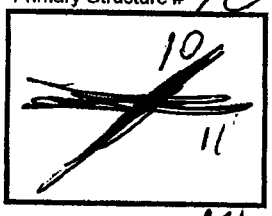

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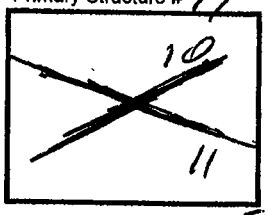

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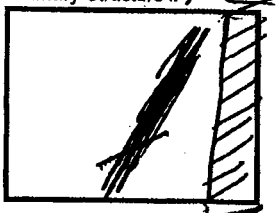

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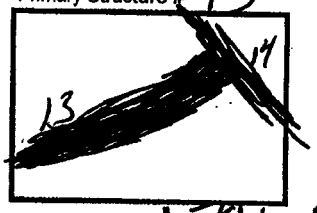

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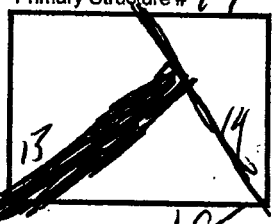

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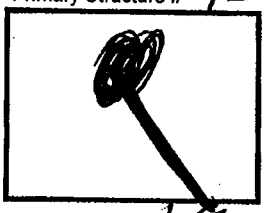

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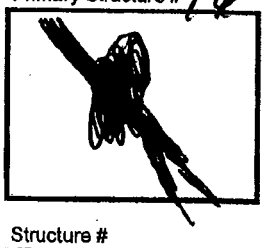
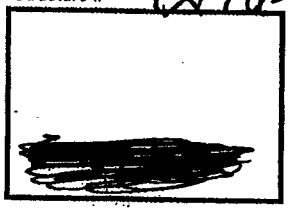


Structure # 17



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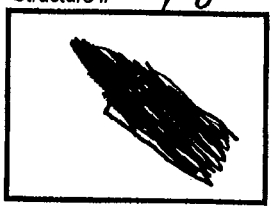
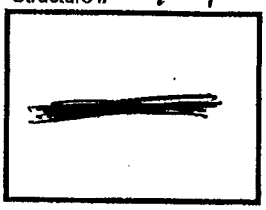


Structure # 19



Structure #

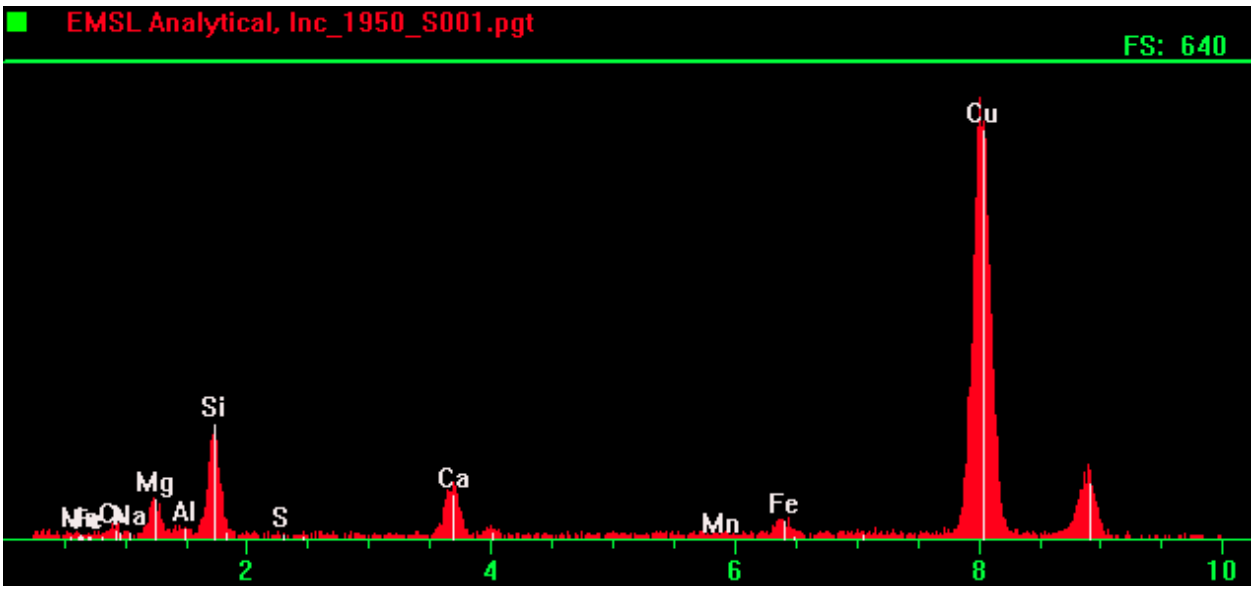
Analyst: KD Date: 27 Sept 12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0028_TEM_ISO_10312_EDX_Actinolite
Collected: September 27, 2012 13:02:53

Live Time:	42.29	Count Rate:	942	Dead Time:	11.95 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



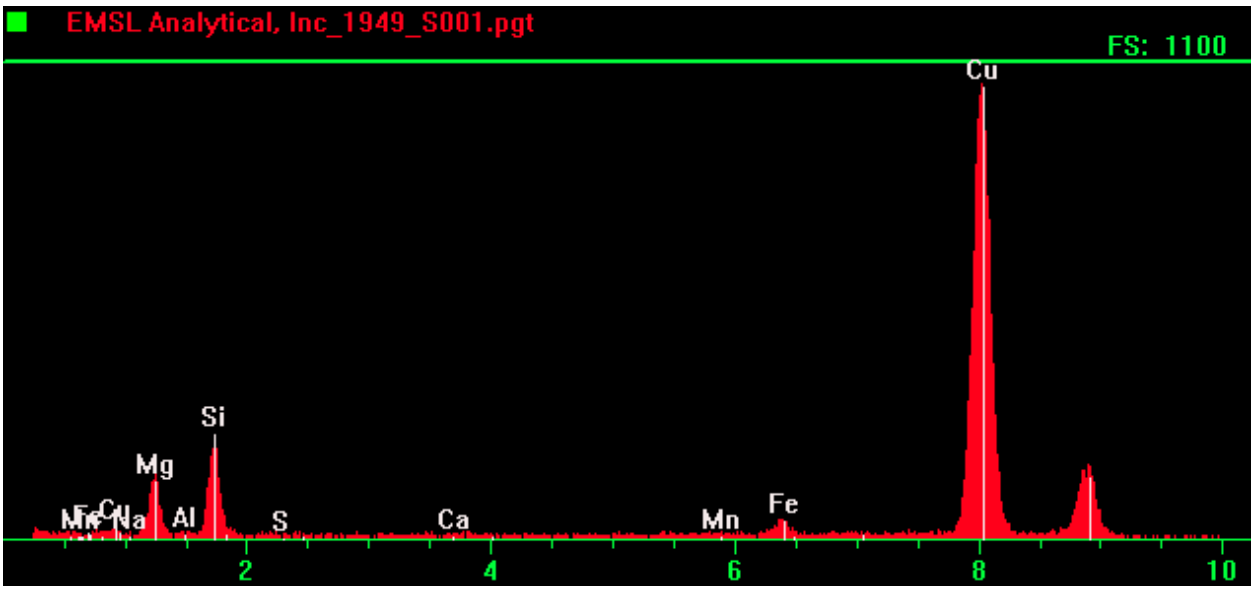
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.1	3.5	0.0	0.0
Mg	KA1	23.1	4.0	19.1	4.8
Al	KA1	7.7	4.1	3.6	0.9
Si	KA1	69.1	3.5	65.5	18.5
S	KA1	3.1	2.6	0.6	0.2
Ca	KA1	41.6	2.9	38.6	13.2
Mn	KA1	5.3	4.3	1.1	0.2
Fe	KA1	15.4	4.3	11.1	2.6
Cu	KA1	390.5	4.6	385.9	83.7

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0028_TEM_ISO_10312_EDX_Chrysotile
Collected: September 27, 2012 12:06:25

Live Time:	61.63	Count Rate:	1123	Dead Time:	14.38 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.6	3.8	0.0	0.0
Mg	KA1	43.5	3.9	39.6	10.2
Al	KA1	4.8	4.1	0.8	0.2
Si	KA1	65.3	3.8	61.4	16.1
S	KA1	3.4	3.1	0.3	0.1
Ca	KA1	4.6	3.5	1.1	0.3
Mn	KA1	5.9	4.8	1.1	0.2
Fe	KA1	19.3	5.3	13.9	2.7
Cu	KA1	505.5	6.2	499.3	81.0

EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/28/12

Indexing of negative number: 44019 SCOPE # 2

Reference / Sample Number: 28

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.6 mm
Mean Distance between spots on Center row (d2): 4.7 mm
Mean distance between spots on slant vector (d1): 5.5 mm

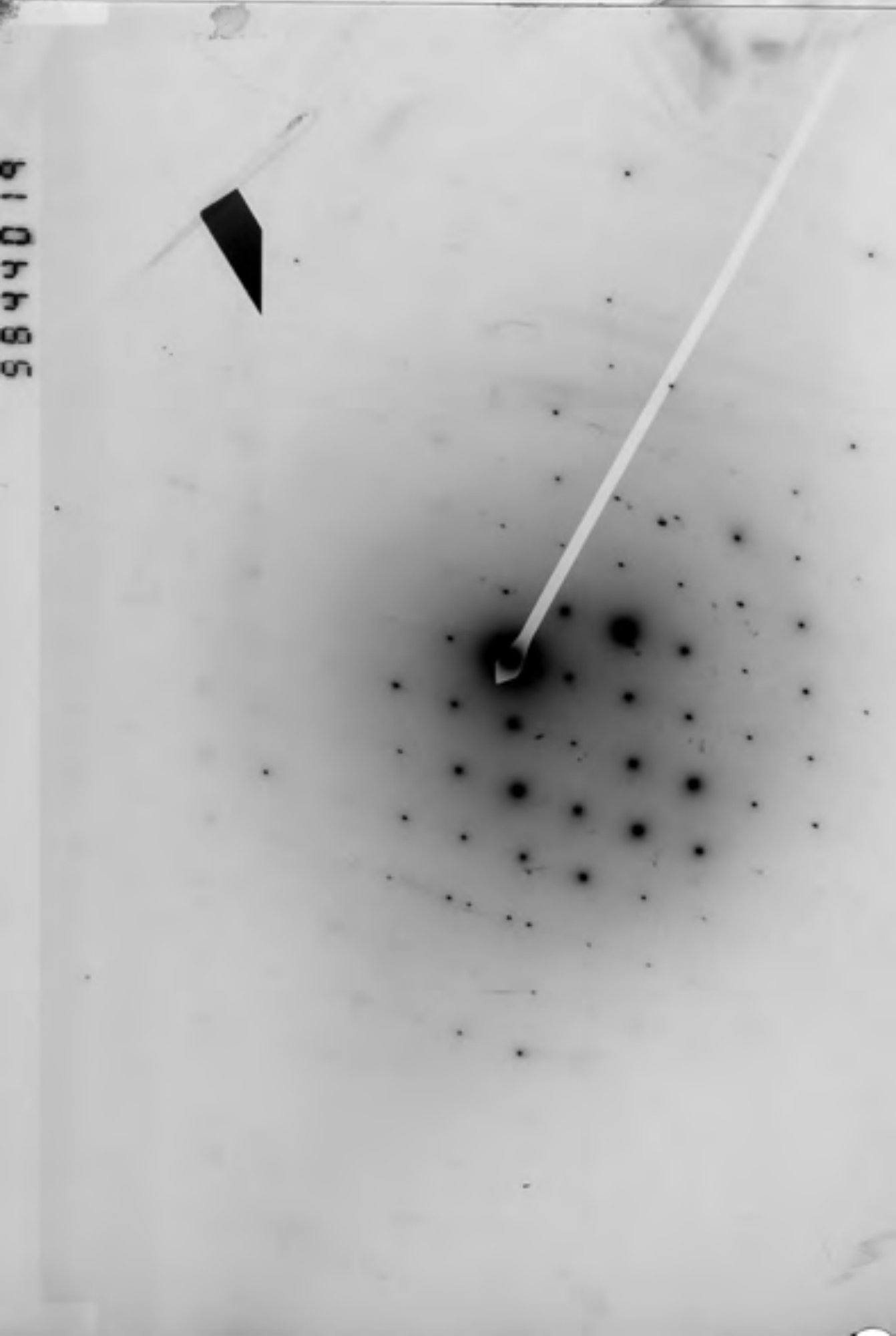
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.19**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**5.08**	5.099	**4.844**	**5.354**
d1 or hk1 (Camera K/slant vector dist.)	**4.34**	4.480	**4.256**	**4.704**
Ratio of hk0/hk1	**1.17**	1.14	**1.083**	**1.197**
Angle of Slant Vector (Measured)	58.0	57.4	**54.530**	**60.270**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [3 -1 2]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/02/12

Indexing of negative number: 43908 SCOPE #: 2

Reference / Sample Number: 0028

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.55 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.20	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

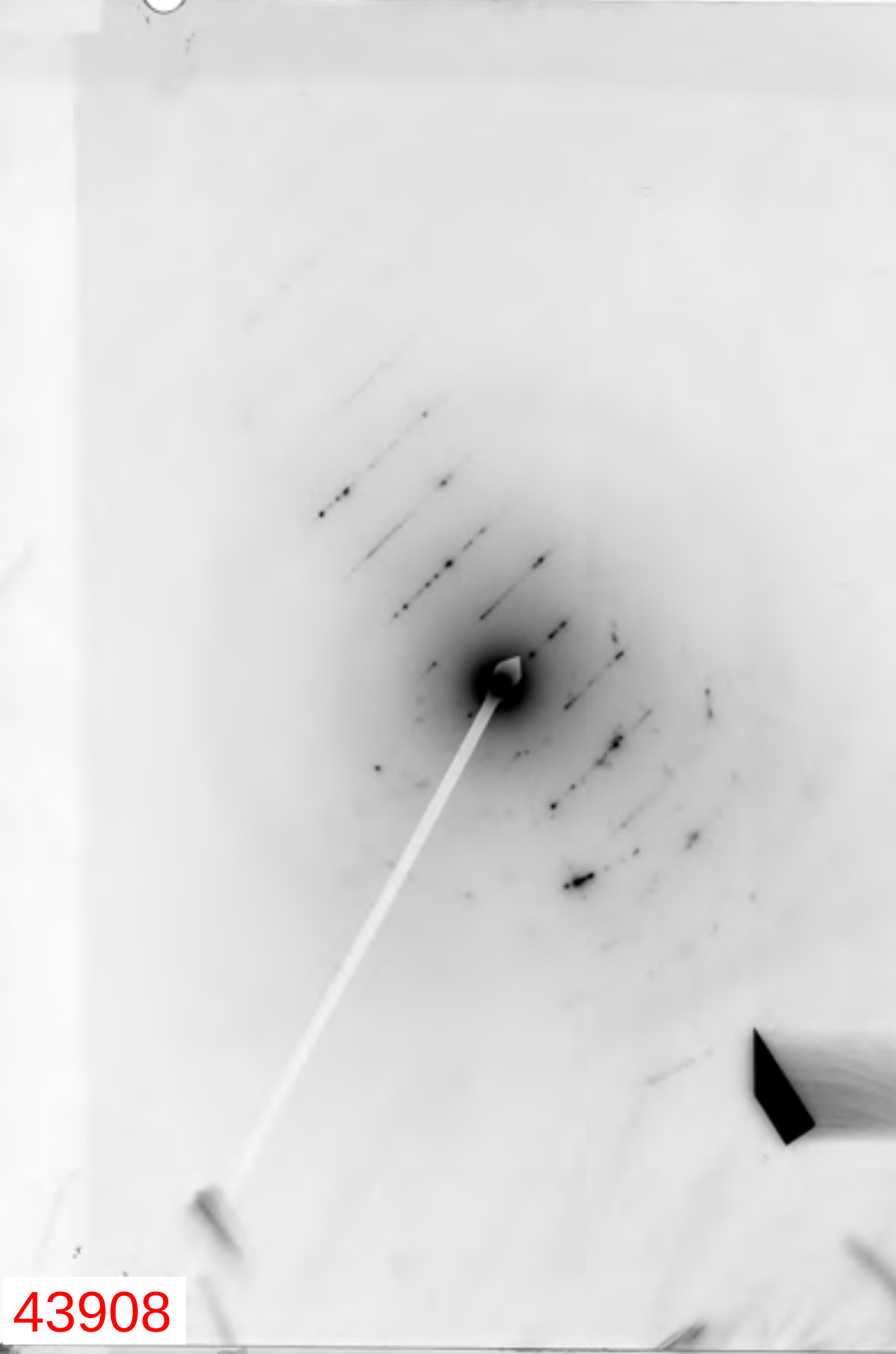
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.26**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.48**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43908

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0029**	Volume (L):	710	Scope:	09-02
Customer Sample:	HM-AP-HK-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	P, 1-3	Analysis Date:	9/30/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/27/12 dm	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
P1	C7	B	1	1	7.1	1.05	CDQ	CHRYS		44020	YES
P1	C7	B	2	2	9.5	2.3	CD	CHRYS			
P1	C7	B	3	3	17.4	2.2	CD	CHRYS			
P1	C5	B	4	4	5.8	1.5	CD	CHRYS			
P1	C3	B	5	5	17.3	1.1	CD	CHRYS			
P1	C3	B	6	6	30.1	5.5	CD	CHRYS			
P1	C3	B	7	7	5.6	1.4	CD	CHRYS			
P1	C1	MD11	8		11.8	7.4	CD	CHRYS			
P1	C1	MB		8	5.2	1.1	CD	CHRYS			
P2	B1	B	9	9	6.1	0.5	CD	CHRYS			

ISO 10312

091211943-0029

TEM Asbestos Count Sheet

P2	B1	B	10	10	10	3.4	CD	CHRYS			
P2	B1	B	11	11	6.1	1.4	CD	CHRYS			
P2	B3	B	12	12	10.2	1.1	CD	CHRYS			
P2	B3	B	13	13	15.6	5.1	CD	CHRYS			
P2	B3	B	14	14	21.3	6.3	CD	CHRYS			
P2	B3	B	15	15	20.05	6.1	CD	CHRYS			
P2	B5	MD11	16		13.9	6.8	CD	CHRYS			
P2	B5	MB		16	5.8	0.4	CD	CHRYS			
P2	B5	B	17	17	5.7	1.3	CD	CHRYS			
P2	B5	MC+0	18	18	10.1	3.9	CD	CHRYS			
P3	D1	ND									
P3	D3	B	19	19	11.2	3.2	CD	CHRYS			
P3	D5	B	20	20	11.6	3.2	CD	CHRYS			
P3	D5	B	21	21	15.1	2.2	CD	CHRYS			
P3	D5	ND									
P3	H6	ND									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

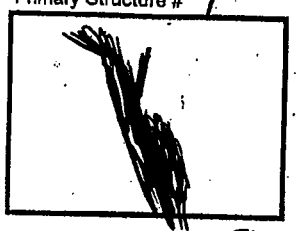
Structure Sketch Sheet

EMSL Order ID: 0912 1943-0029 **Client:**

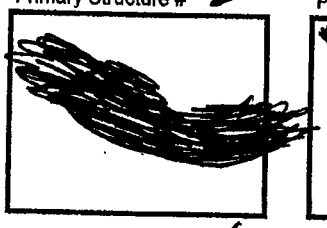
Client Sample:

Page 1 of 2

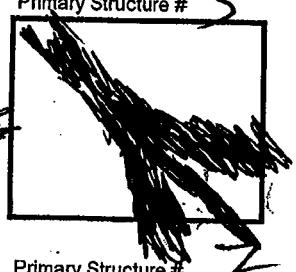
Primary Structure # 1



Primary Structure # 2



Primary Structure # 3



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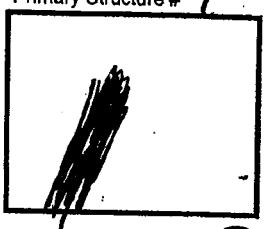

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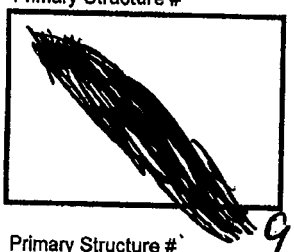

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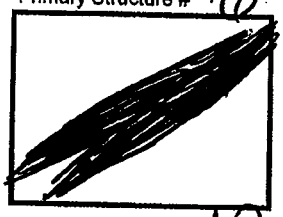

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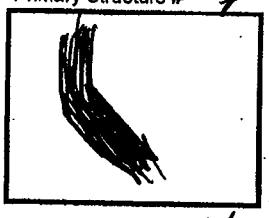

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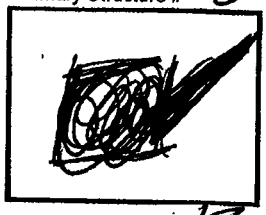

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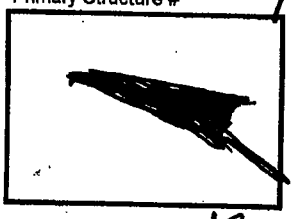

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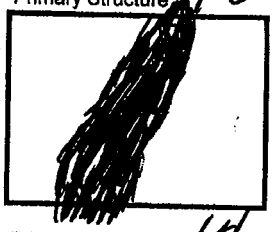

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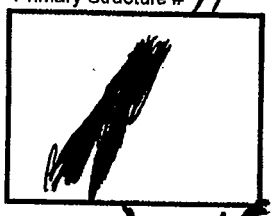

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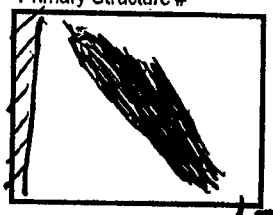

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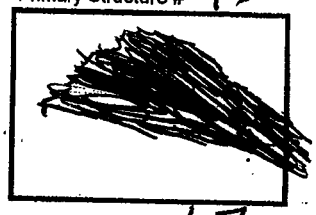

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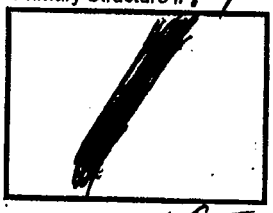

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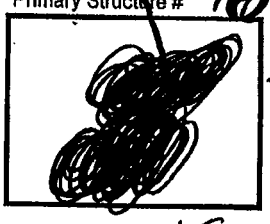
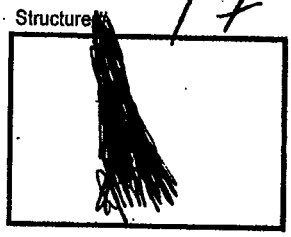


Primary Structure # 15

Structure # 17



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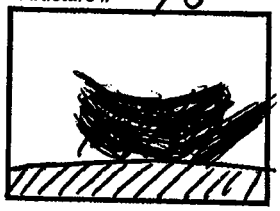


Structure # 19

Structure # 20

Analyst: KD Date: 30 Sep 12 Scope: Z

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 0912 11943-0029 Client:

Client Sample:

Page 2 of 2

Primary Structure # 1	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Structure #	Structure #	Structure #	Structure #

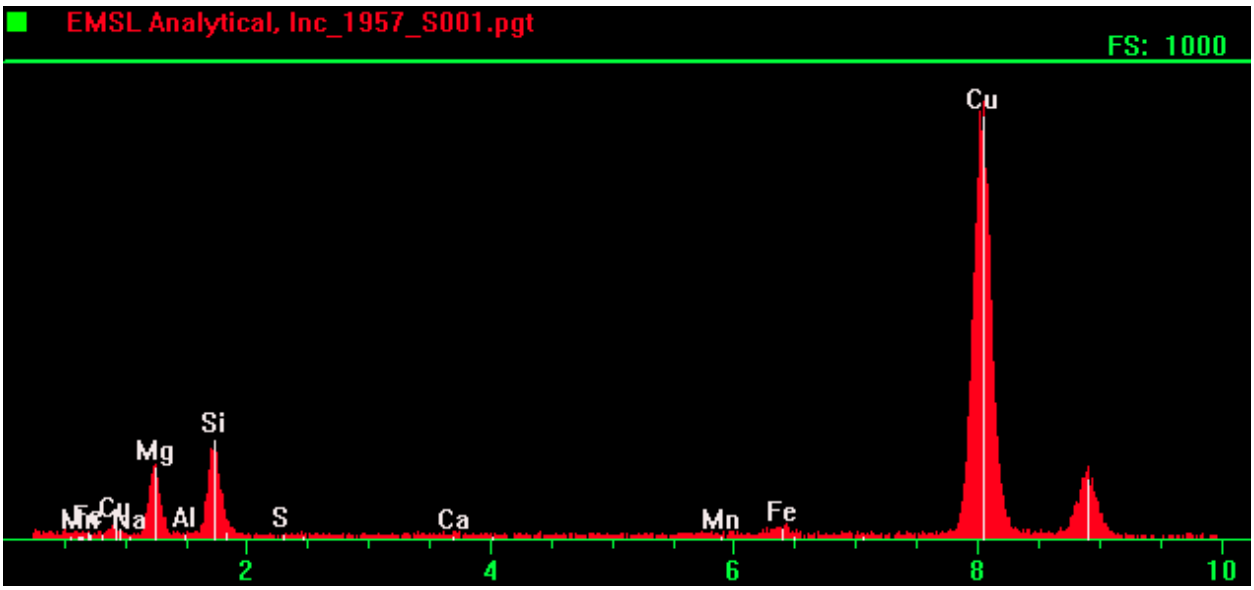
Analyst: KD Date: 30 Sept 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0029_TEM_ISO_10312_EDX_Chrysotile
Collected: September 30, 2012 10:31:26

Live Time:	29.20	Count Rate:	2145	Dead Time:	26.37 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	7.9	8.7	0.0	0.0
Mg	KA1	98.8	9.0	89.8	9.9
Al	KA1	10.3	9.5	0.9	0.1
Si	KA1	136.3	8.9	127.4	14.3
S	KA1	7.6	7.5	0.0	0.0
Ca	KA1	9.2	6.2	3.0	0.5
Mn	KA1	10.7	9.7	1.0	0.1
Fe	KA1	23.9	9.9	14.0	1.4
Cu	KA1	917.1	15.1	902.1	59.9

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/20/12

Indexing of negative number: 44020 SCOPE #: 2

Reference / Sample Number: 29

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

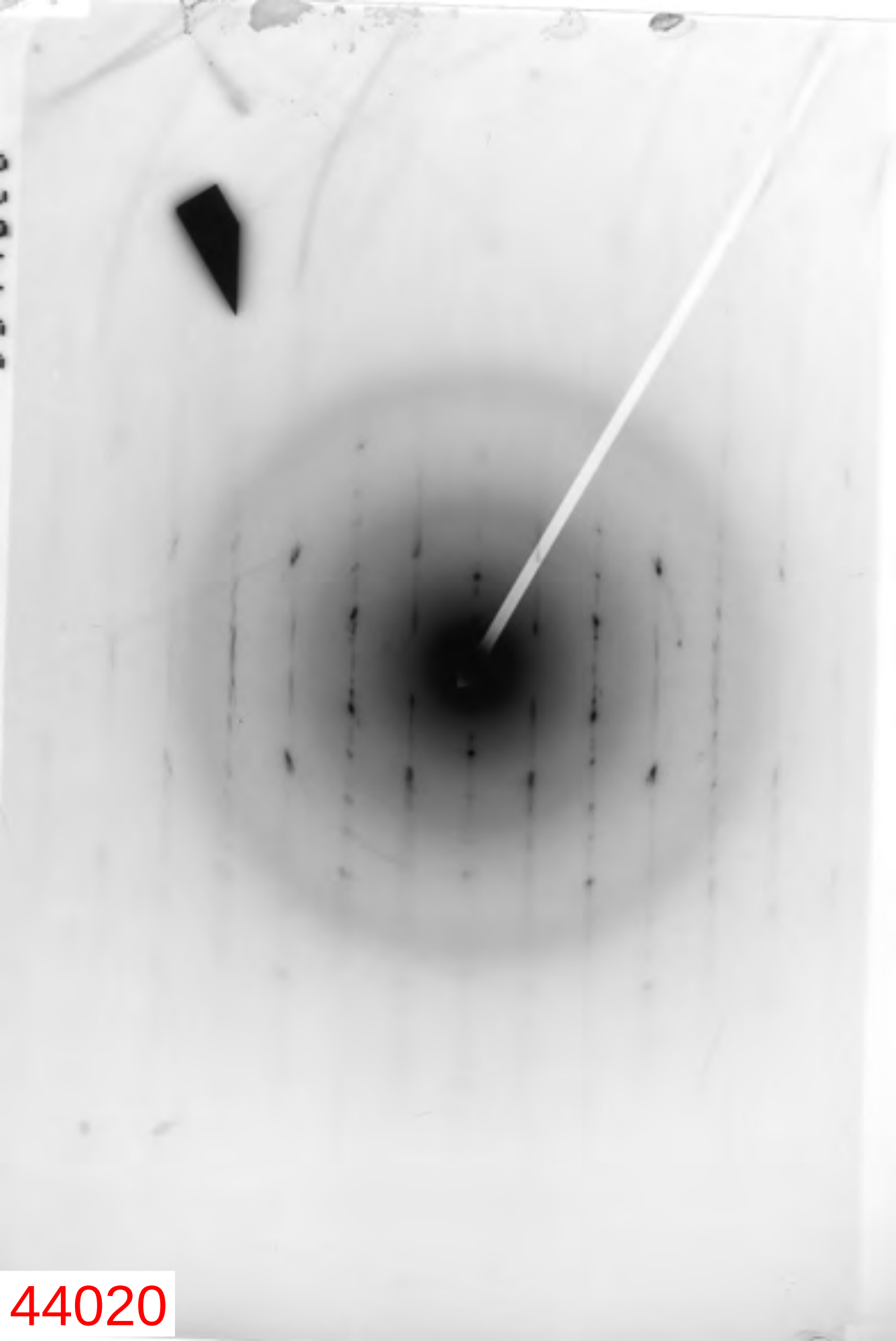
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



44020

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0030**	Volume (L):	707	Scope:	09-02
Customer Sample:	HM-AP-HK-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	P, 4-6	Analysis Date:	10/3/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	~~11~~ 12 11/20/12 DM	none	3:1	5:1	
GO Analyzed:	~~12~~ 12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/20/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
P4	E7	B	1	1	10.8	2.1	CD	CHRYS			
P4	E7	B	2	2	10.55	2.4	CD	CHRYS			
P4	E7	B	3	3	16.1	1.8	CD	CHRYS			
P4	E7	B	4	4	7.8	0.8	CD	CHRYS			
P4	E5	B	5	5	10.4	2.1	CD	CHRYS			YES
P4	E5	MD11	6		9.8	1	CD	CHRYS			
P4	E5	MB		6	7.8	0.8	CD	CHRYS			
P4	E5	MD11	7		12.3	3	CD	CHRYS			
P4	E5	MB		7	7	1	CD	CHRYS			
P4	E5	B	8	8	10.9	1.2	CD	CHRYS			

ISO 10312

091711943-0030

TEM Asbestos Count Sheet

P4	E3	MD11	9		20.8	13	CD	CHRYS			
P4	E3	MB		9	10.1	0.3	CD	CHRYS			
P4	E3	B	10	10	21.1	2.4	CD	CHRYS			
P4	E1	B	11	11	14.1	1.2	CD	CHRYS			
P5	D9	B	12	12	33.6	1.3	CD	CHRYS			
P5	D7	B	13	13	6.4	1.1	CD	CHRYS			
P5	D7	B	14	14	5.8	0.25	ADX	ACTIN		43925	YES
P5	D7	F	15	15	6.3	1	CD	CHRYS			
P5	D5	B	16	16	16.6	2.4	CD	CHRYS			
P5	D5	B	17	17	44.2	2.1	CD	CHRYS			
P5	D5	B	18	18	6.5	0.3	CD	CHRYS			
P5	D3	B	19	19	13.3	0.35	CD	CHRYS			
P5	D3	B	20	20	14.3	1	CD	CHRYS			
P5	D3	B	21	21	7.3	1.8	CD	CHRYS			
P5	D1	B	22	22	16.2	2.2	CD	CHRYS			
P5	D1	B	23	23	24.2	6	CD	CHRYS			
P5	D1	B	24	24	11.6	3.1	CD	CHRYS			
P6	D5	B	25	25	20.8	5	CD	CHRYS			
P6	D5	B	26	26	6.1	1.1	CD	CHRYS			
P6	D5	B	27	27	5.55	0.4	CD	CHRYS			
P6	D5	B	28	28	8.6	0.5	CD	CHRYS			
P6	D7	B	29	29	5.7	1	CD	CHRYS			
P6	D9	B	30	30	31.2	4	CD	CHRYS			
P6	D9	B	31	31	6.6	1.3	CD	CHRYS			
P6	D9	B	32	32	9.2	0.6	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

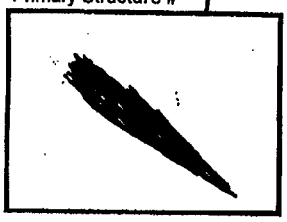
Structure Sketch Sheet

EMSL Order ID: 0912119 43-0030 **Client:**

Client Sample:

Page 1 of 2

Primary Structure # 1



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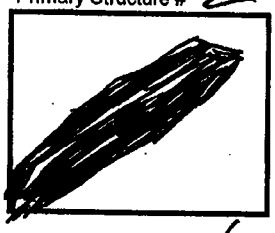

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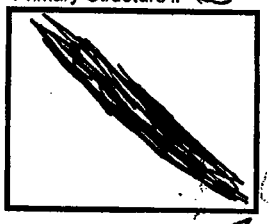

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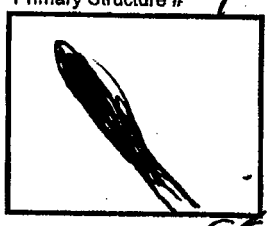
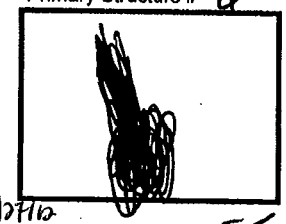


Primary Structure # 5

Primary Structure # 6



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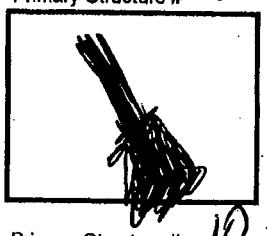

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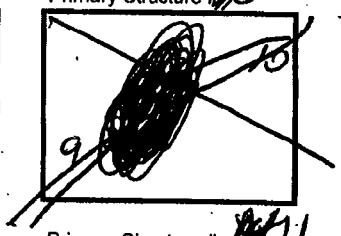
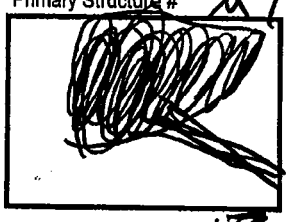


Primary Structure # ~~9~~ 11/27/12 DM



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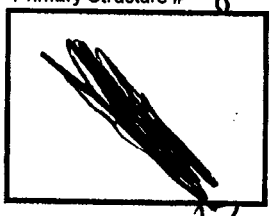

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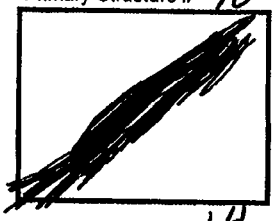

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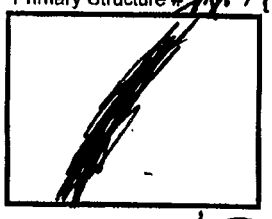

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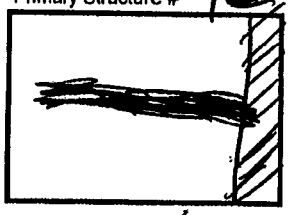

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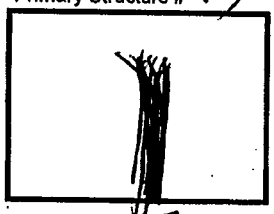

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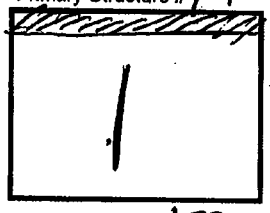

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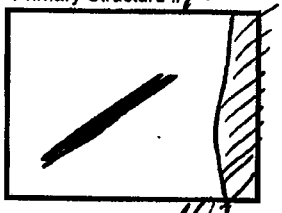
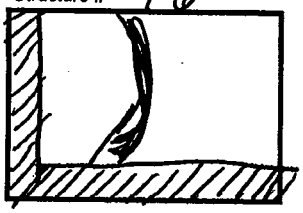
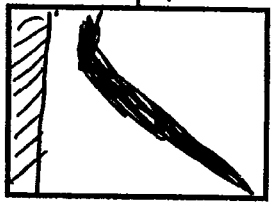


Structure # 16



Structure # 17



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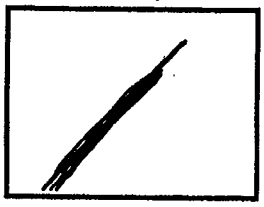

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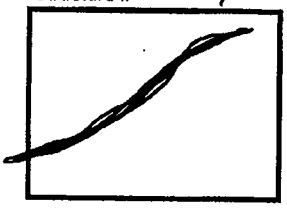


Analyst: KD Date: 30CT12 Scope: 2

TEM ISO 10312

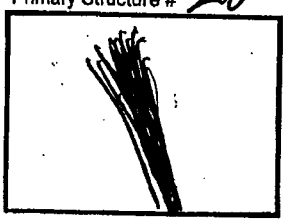
Structure Sketch Sheet

EMSL Order ID: 09121943-0030 Client:

Client Sample:

Page 2 of 2

Primary Structure # 20



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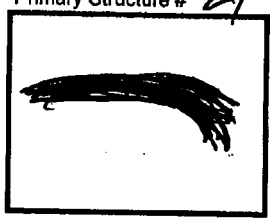

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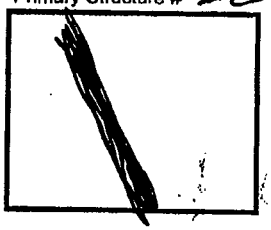

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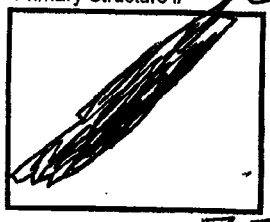
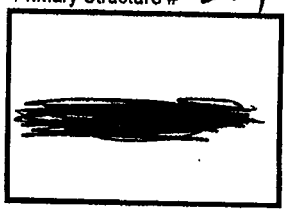


Primary Structure # 24



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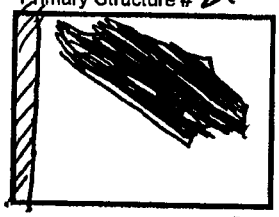
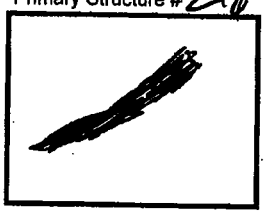
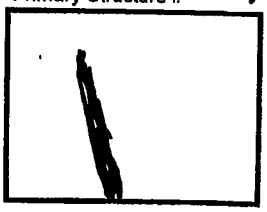


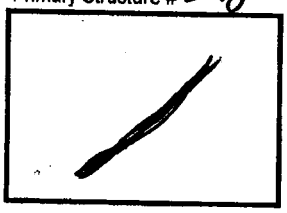
Primary Structure # 26



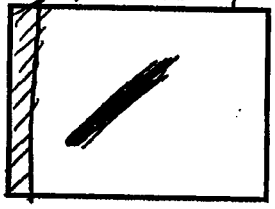
Primary Structure # 27



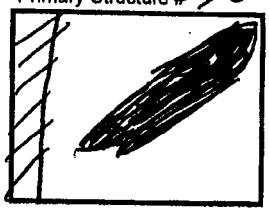
Primary Structure # 28



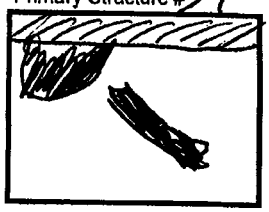
Primary Structure # 29



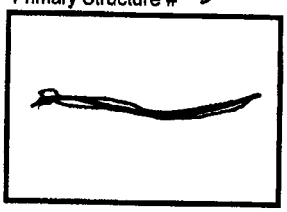
Primary Structure # 30



Primary Structure # 31



Primary Structure # 32



Primary Structure #

Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

Analyst: KD

Date: 30CT12

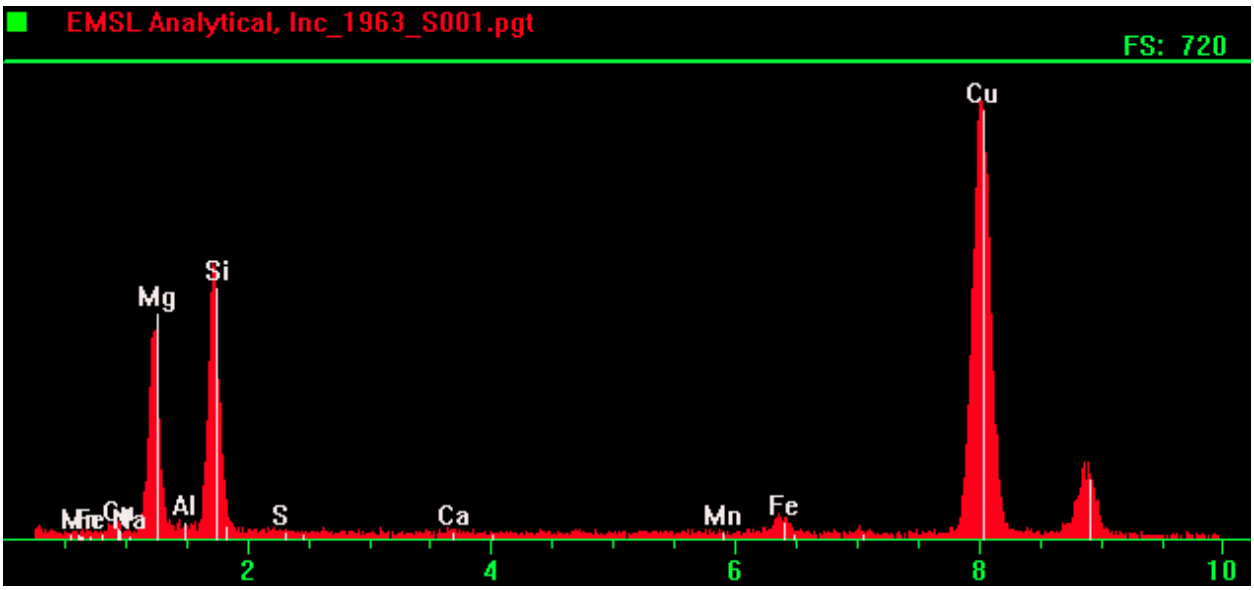
Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0030_TEM_ISO_10312_EDX_Chrysotile
Collected: October 03, 2012 15:41:05

Live Time:	78.23	Count Rate:	771	Dead Time:	9.51 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.3	2.7	0.1	0.1
Mg	KA1	73.4	3.1	70.3	22.9
Al	KA1	6.4	3.3	3.1	0.9
Si	KA1	97.9	3.6	94.4	26.4
S	KA1	4.1	3.1	1.0	0.3
Ca	KA1	3.7	2.7	1.0	0.4
Mn	KA1	3.6	3.1	0.5	0.2
Fe	KA1	12.8	3.3	9.4	2.8
Cu	KA1	255.9	3.5	252.4	72.3

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 44021 SCOPE #: 2

Reference / Sample Number: 30

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.51 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.20	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.31**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.60**	**4.58**	**4.351**	**4.809**

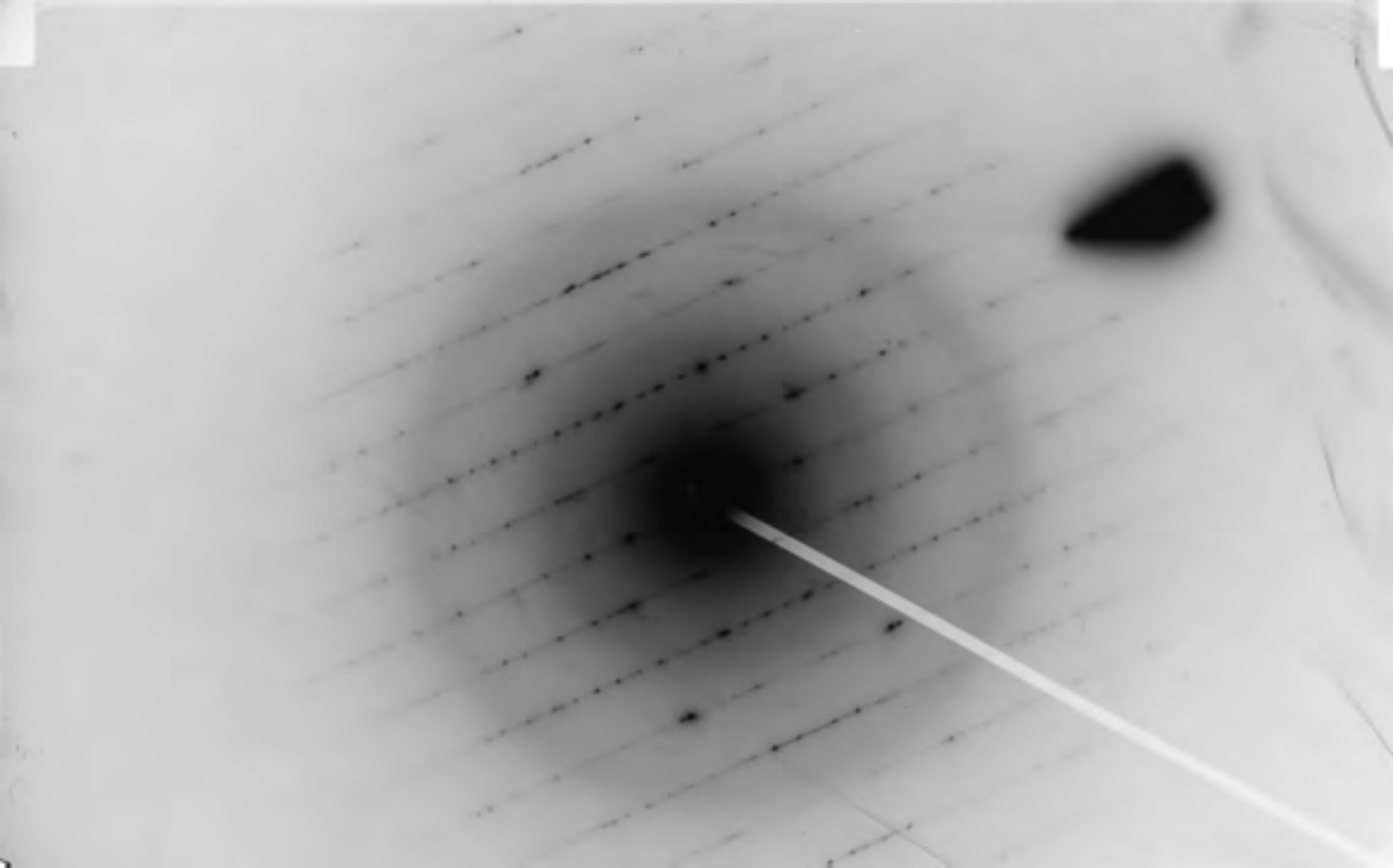
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

5544021



EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43925 SCOPE # 2

Reference / Sample Number: 30

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.53 mm
Mean Distance between spots on Center row (d2): 2.82 mm
Mean distance between spots on slant vector (d1): 5.22 mm

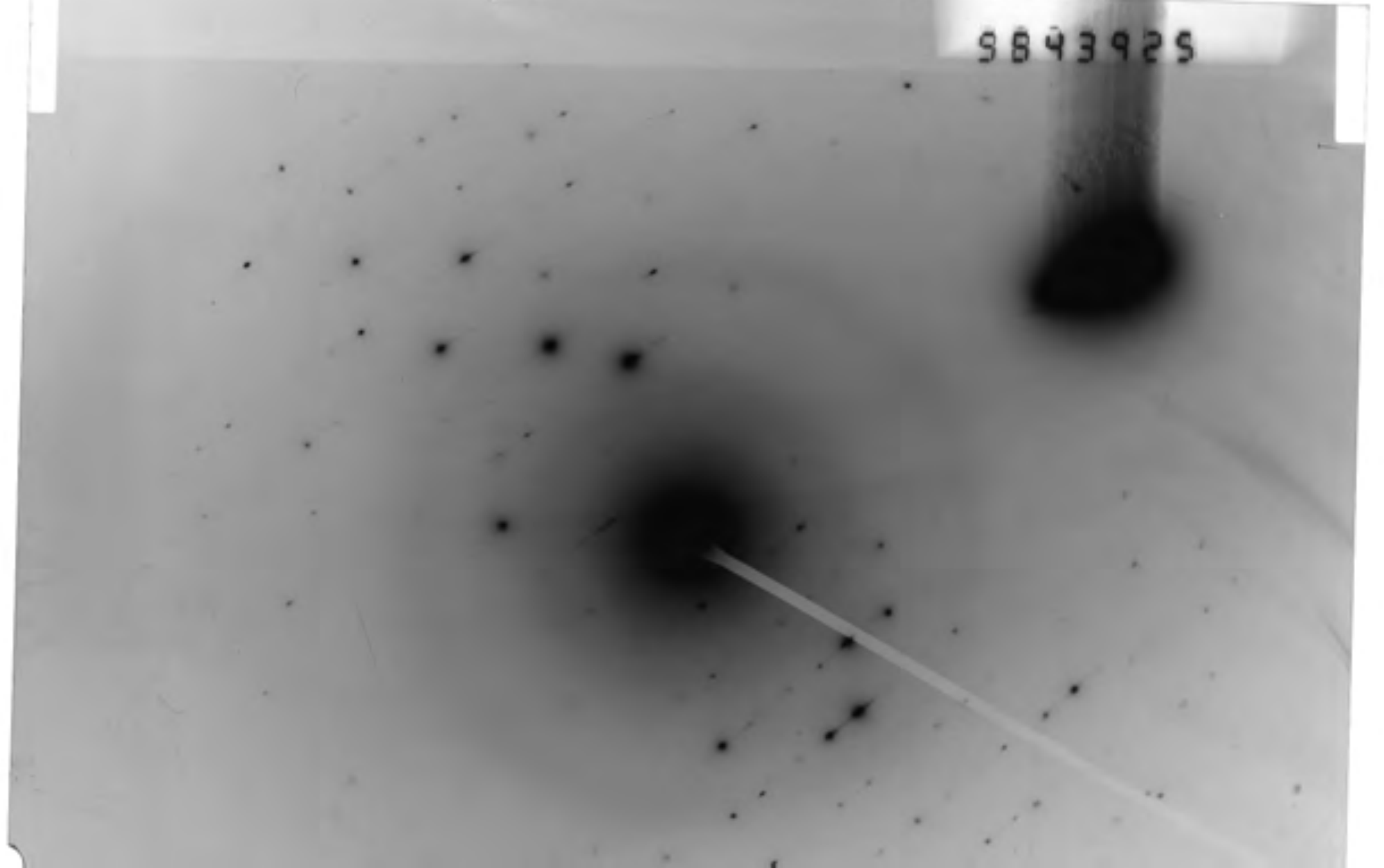
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.27**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**8.47**	8.429	**8.008**	**8.850**
d1 or hk1 (Camera K/slant vector dist.)	**4.58**	4.482	**4.258**	**4.706**
Ratio of hk0/hk1	**1.85**	1.88	**1.786**	**1.974**
Angle of Slant Vector (Measured)	64.0	64.6	**61.370**	**67.830**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [1 -1 2]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____


9843925

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0031**	Volume (L):	668	Scope:	09-02
Customer Sample:	HM-AP-HK-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12A001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	Q, 1-3	Analysis Date:	10/3/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		**Comments:**
GO Required:	12	none	3:1 5:1	
GO Analyzed:	12			
Level of Analysis Chrysotile:	CDQ 11/27/12 DM	Min Length:	>5 ~~0.5~~ 11/27/12 DM micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25 ~~NONE~~ micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
Q1	E3	B	1	1	9.8	2.5	CD	CHRYS			
Q1	E3	B	2	2	17	2.1	CDQ	CHRYS		43926	YES
Q1	E3	B	3	3	22.1	5	CD	CHRYS			
Q1	E5	ND									
Q1	E7	B	4	4	6.5	0.55	CD	CHRYS			
Q1	E9	ND									
Q2	D1	B	5	5	12.3	2.6	CD	CHRYS			
Q2	D3	MD11	6		10.1	3.2	CD	CHRYS			
Q2	D3	MB		6	10.1	1.3	CD	CHRYS			
Q2	D3	B	7	7	22.4	2.3	CD	CHRYS			

ISO 10312

091211943-0031

TEM Asbestos Count Sheet

Q2	D5	ND									
Q2	D7	B	8	8	22.1	2.2	CD	CHRYS			
Q3	D3	B	9	9	16.8	2.3	CD	CHRYS			
Q3	D5	ND									
Q3	D7	ND									
Q3	D9	B	10	10	6.8	0.6	CD	CHRYS			
Q3	D9	B	11	11	10	1	CD	CHRYS			
Q3	D9	B	12	12	8.1	0.7	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

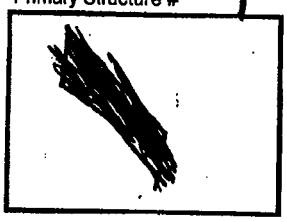
Structure Sketch Sheet

EMSL Order ID: 0912119413-0037 **Client:**

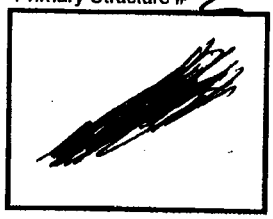
Client Sample:

Page 1 of 1

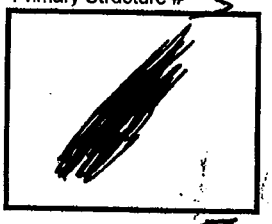
Primary Structure # 1



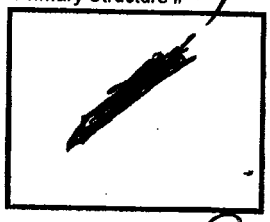
Primary Structure # 2



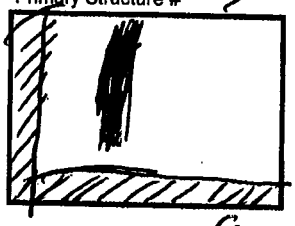
Primary Structure # 3



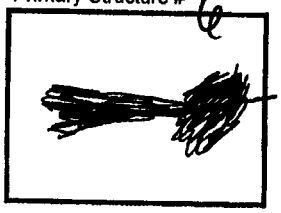
Primary Structure # 4



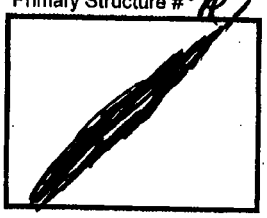
Primary Structure # 5



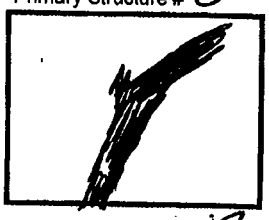
Primary Structure # 6



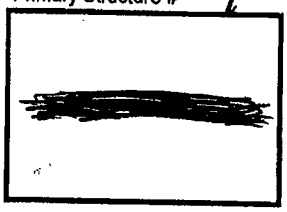
Primary Structure # 7



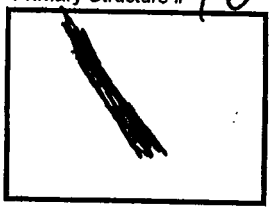
Primary Structure # 8



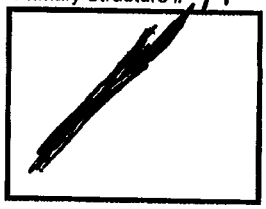
Primary Structure # 9



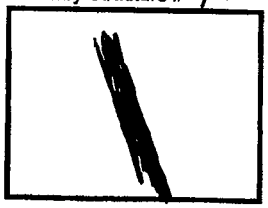
Primary Structure # 10



Primary Structure # 11



Primary Structure # 12



Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

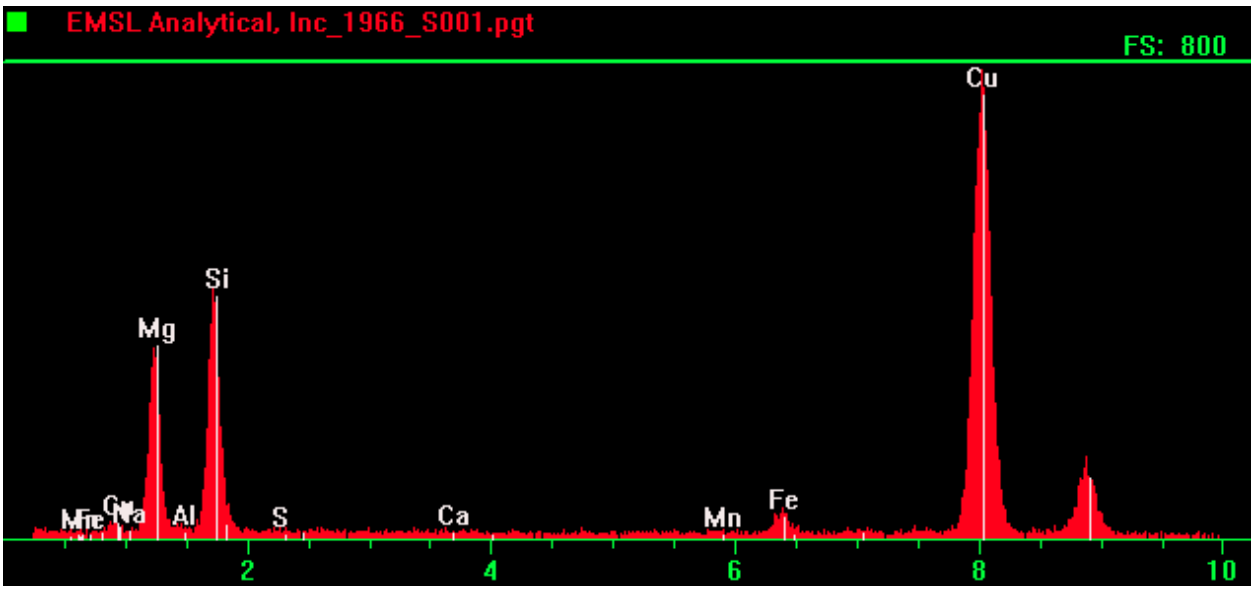
Analyst: KD Date: 8 OCT 12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0031_TEM_ISO_10312_EDX_Chrysotile
Collected: October 04, 2012 11:21:44

Live Time:	38.60	Count Rate:	1740	Dead Time:	20.71 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	7.4	8.1	0.0	0.0
Mg	KA1	151.4	9.3	142.0	15.2
Al	KA1	11.5	9.7	1.7	0.2
Si	KA1	215.3	10.1	205.2	20.3
S	KA1	8.7	8.9	0.0	0.0
Ca	KA1	7.8	6.7	1.1	0.2
Mn	KA1	8.7	7.8	0.9	0.1
Fe	KA1	30.3	8.6	21.6	2.5
Cu	KA1	561.9	10.1	551.8	54.6

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 31 SCOPE #: 2

Reference / Sample Number: 43926 11/27/12 DM

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No 4.3

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

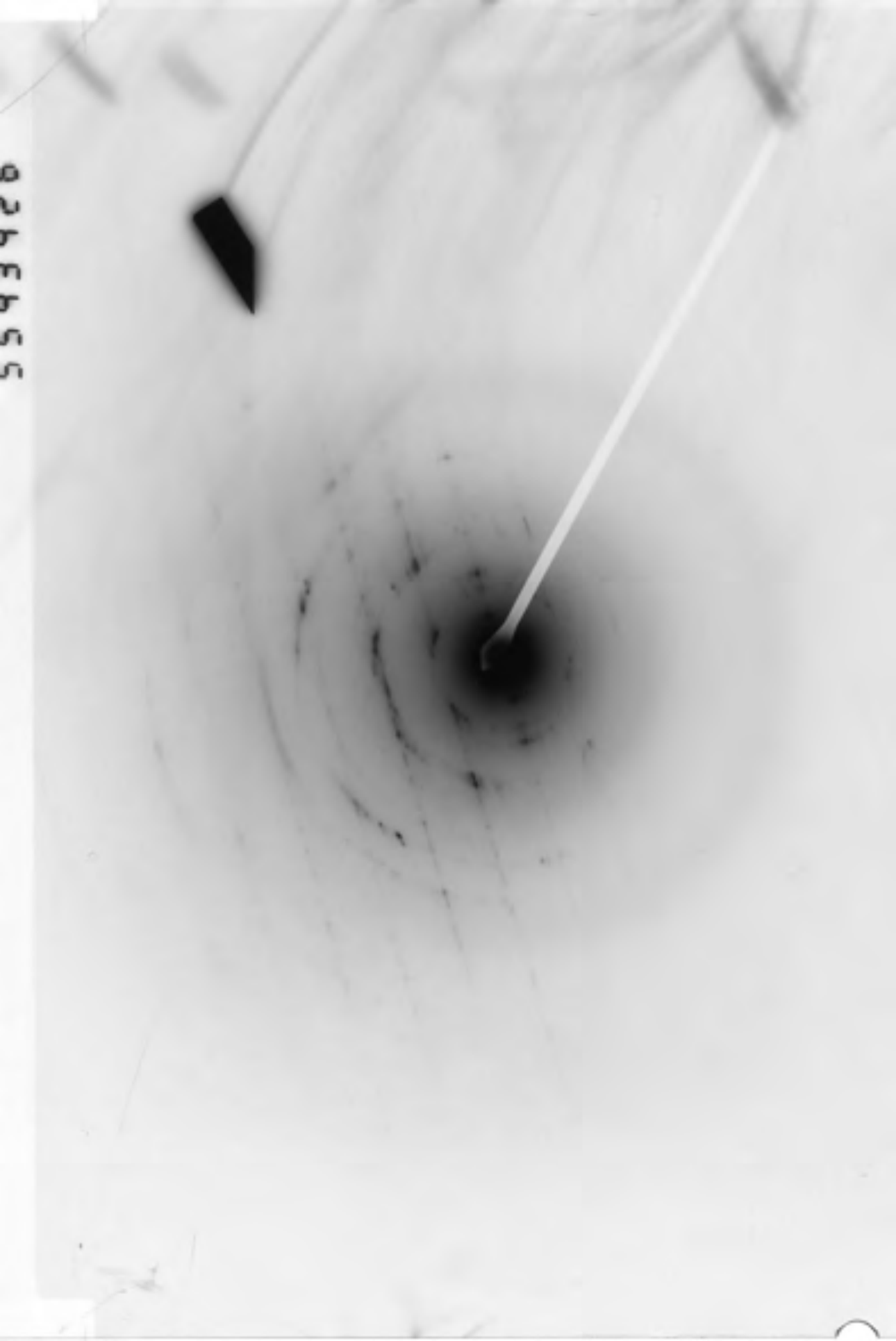
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	59	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0032	Volume (L):	685	Scope:	09-02
Customer Sample:	HM-AP-HK-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	Q, 4-6	Analysis Date:	10/4/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	~~11~~ 12 11/27/12 DM	none	3:1	5:1	
GO Analyzed:	~~12~~ 12				
Level of Analysis Chrysotile:	CDQ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
Q4	I1	B	1	1	10.1	1.95	CD	CHRYS			
Q4	I1	B	2	2	10.7	2.2	CD	CHRYS		44022 ~~43927~~	12/4/12 DM
Q4	I3	MD11	3		12.2	11.8	ADX	ACTINOLITE			
Q4	I3	MB		3	5.5	0.3	ADX	ACTINOLITE		43928	YES
Q4	I3	B	4	4	12.8	3.2	CDQ	CHRYS			YES
Q4	I3	MD11	5		16.5	5.5	CD	CHRYS			
Q4	I3	MB		5	8.6	1.2	CD	CHRYS			
Q4	I3	B	6	6	9.8	2.2	CD	CHRYS			
Q4	I3	MD11	7		14.4	5	CD	CHRYS			
Q4	I3	MB		7	6	0.25	CD	CHRYS			

ISO 10312

091211943-0032

TEM Asbestos Count Sheet

Q4	I3	B	8	8	7.2	0.35	CD	CHRYS			
Q4	I3	B	9	9	17.4	3.5	CD	CHRYS			
Q4	I5	B	10	10	27.2	1.1	CD	CHRYS			
Q4	I5	B	11	11	10.8	1.1	CD	CHRYS			
Q4	I5	B	12	12	72.4	10.3	CD	CHRYS			
Q4	I7	B	13	13	5.8	1.2	CD	CHRYS			
Q4	I7	B	14	14	6.1	1.3	CD	CHRYS			
Q4	I7	MD11	15		10.4	3.2	CD	CHRYS			
Q4	I7	MB		15	8.8	2.4	CD	CHRYS			
Q5	H2	B	16	16	13.8	4.2	CD	CHRYS			
Q5	H2	B	17	17	62.1	3	CD	CHRYS			
Q5	H2	B	18	18	10.8	1.3	CD	CHRYS			
Q5	H4	B	19	19	5.2	0.45	CD	CHRYS			
Q5	H6	B	20	20	5.2	1.1	CD	CHRYS			
Q5	H8	B	21	21	7.3	1.8	CD	CHRYS			
Q5	H8	B	22	22	5.5	1.3	CD	CHRYS			
Q5	H10	B	23	23	16	4.5	CD	CHRYS			
Q5	H10	B	24	24	6.2	0.3	CD	CHRYS			
Q5	H10	MD11	25		9.6	4.3	CD	CHRYS			
Q5	H10	MB		25	9.6	0.8	CD	CHRYS			
Q6	F1	B	26	26	27.1	3.1	CD	CHRYS			
Q6	F3	ND									
Q6	F5	ND									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

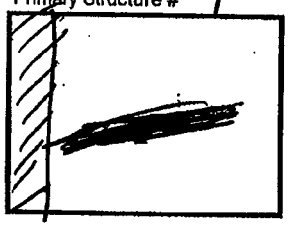
Structure Sketch Sheet

EMSL Order ID: 0912119413-0032 **Client:**

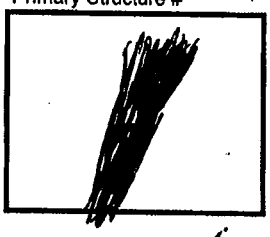
Client Sample:

Page 1 of 2

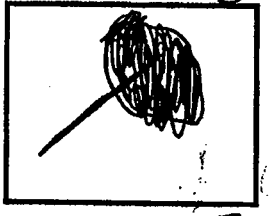
Primary Structure # 1



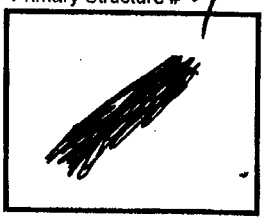
Primary Structure # 2



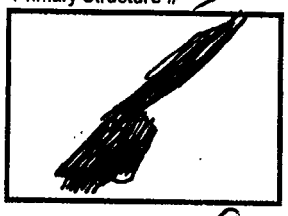
Primary Structure # 3



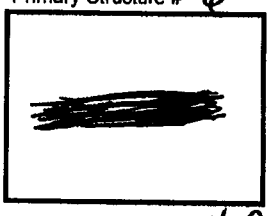
Primary Structure # 4



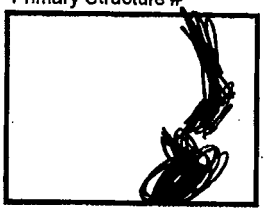
Primary Structure # 5



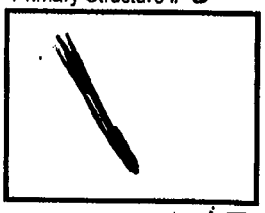
Primary Structure # 6



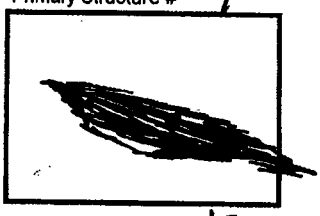
Primary Structure # 7



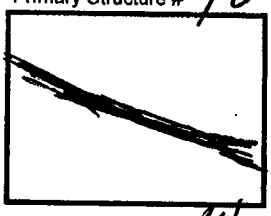
Primary Structure # 8



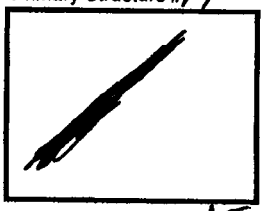
Primary Structure # 9



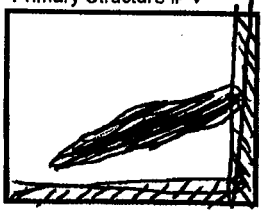
Primary Structure # 10



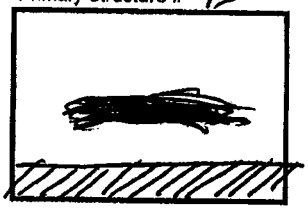
Primary Structure # 11



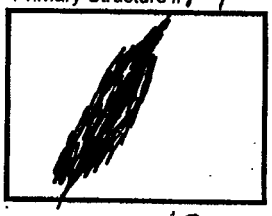
Primary Structure # 12



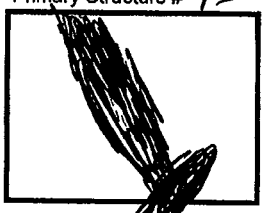
Primary Structure # 13



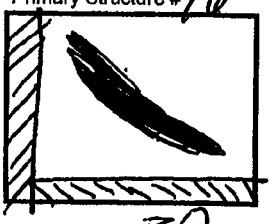
Primary Structure # 14



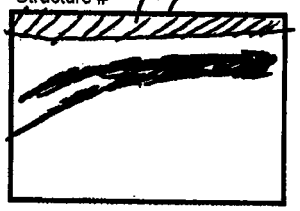
Primary Structure # 15



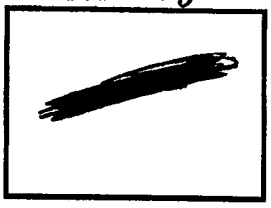
Primary Structure # 16



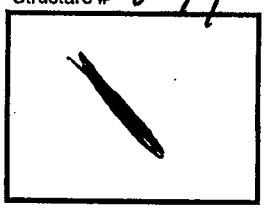
Structure # 17



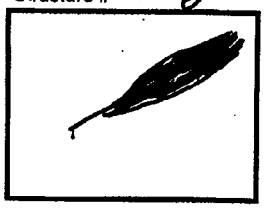
Structure # 18



Structure # 19



Structure # 20



Analyst: KD Date: 4 OCT 12 Scope: 2

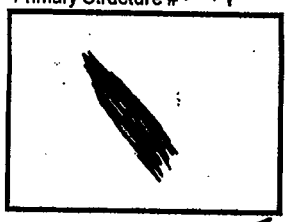
TEM ISO 10312

Structure Sketch Sheet

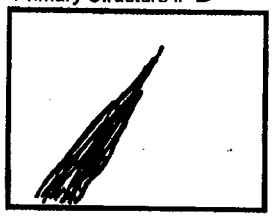
EMSL Order ID: 091211943-0032 **Client:**

Client Sample: _____ Page 2 of 2

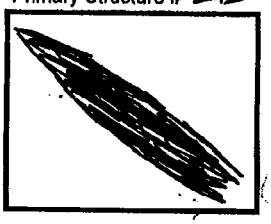
Primary Structure # 21



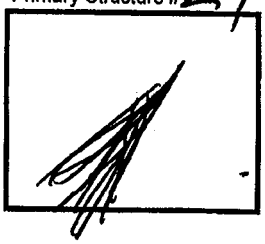
Primary Structure # 22



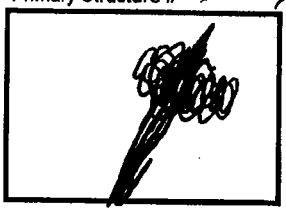
Primary Structure # 23



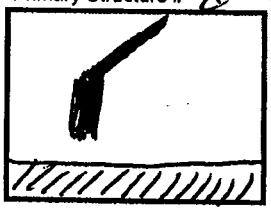
Primary Structure # 24



Primary Structure # 325



Primary Structure # 326



Primary Structure #

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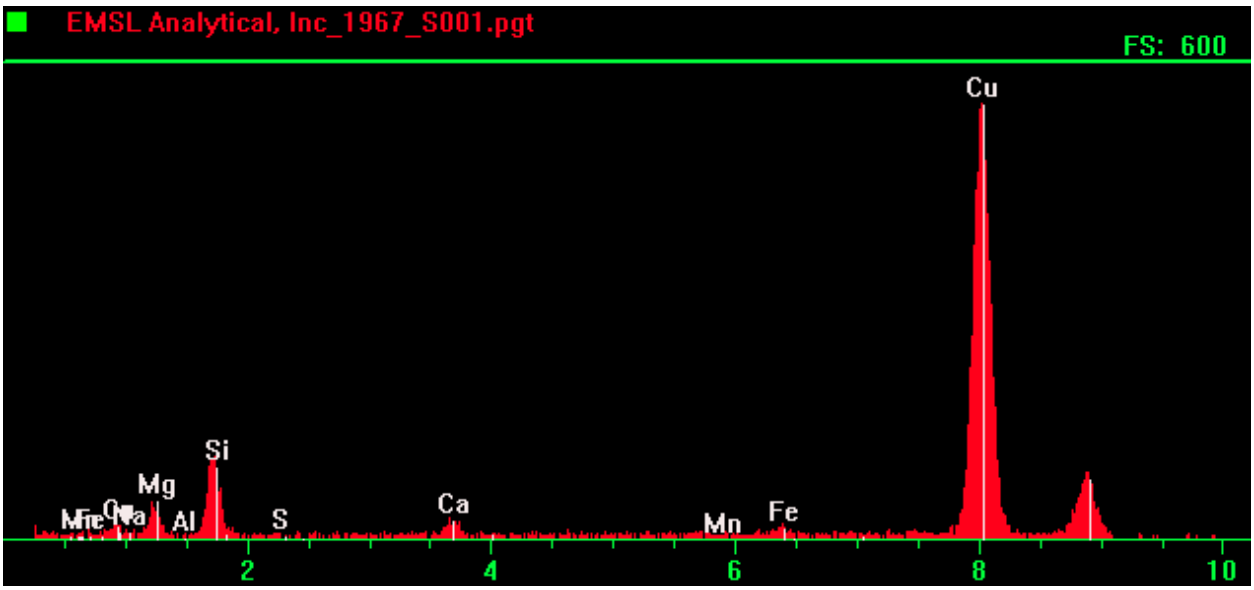
Analyst: KD Date: 4 OCT 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0032_TEM_ISO_10312_EDX_Actinolite
Collected: October 04, 2012 12:15:23

Live Time:	41.85	Count Rate:	811	Dead Time:	10.58 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



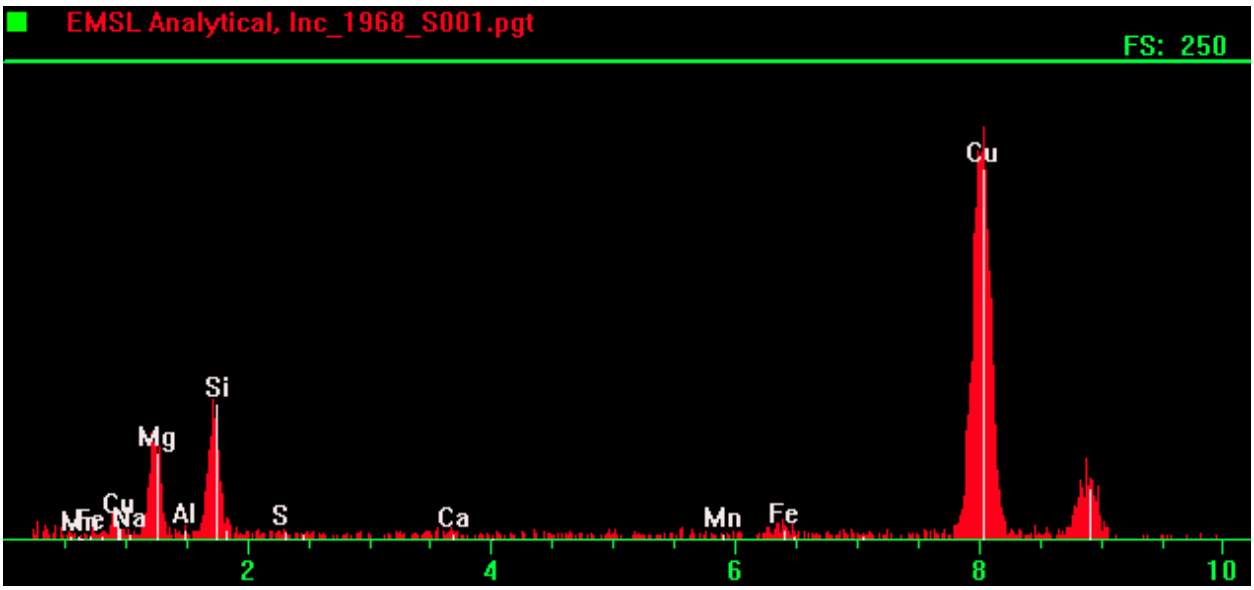
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.6	2.2	0.7	0.3
Mg	KA1	18.0	2.3	15.7	6.8
Al	KA1	2.2	2.4	0.0	0.0
Si	KA1	51.0	2.5	48.5	19.5
S	KA1	2.3	1.9	0.3	0.2
Ca	KA1	13.9	2.9	11.0	3.8
Mn	KA1	3.8	3.4	0.4	0.1
Fe	KA1	9.3	3.5	5.8	1.6
Cu	KA1	374.0	3.7	370.2	99.3

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0032_TEM_ISO_10312_EDX_Chrysotile
Collected: October 04, 2012 12:27:07

Live Time:	76.48	Count Rate:	205	Dead Time:	3.07 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	0.8	0.9	0.0	0.0
Mg	KA1	13.8	0.9	12.8	13.6
Al	KA1	1.2	1.0	0.3	0.3
Si	KA1	17.6	1.0	16.5	16.2
S	KA1	0.9	0.7	0.2	0.3
Ca	KA1	1.1	0.4	0.7	1.8
Mn	KA1	0.9	0.5	0.4	0.8
Fe	KA1	2.7	1.0	1.7	1.6
Cu	KA1	82.3	1.0	81.3	79.7

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 32 SCOPE #: 2

Reference / Sample Number: 44022

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No 4.3

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.25	mm

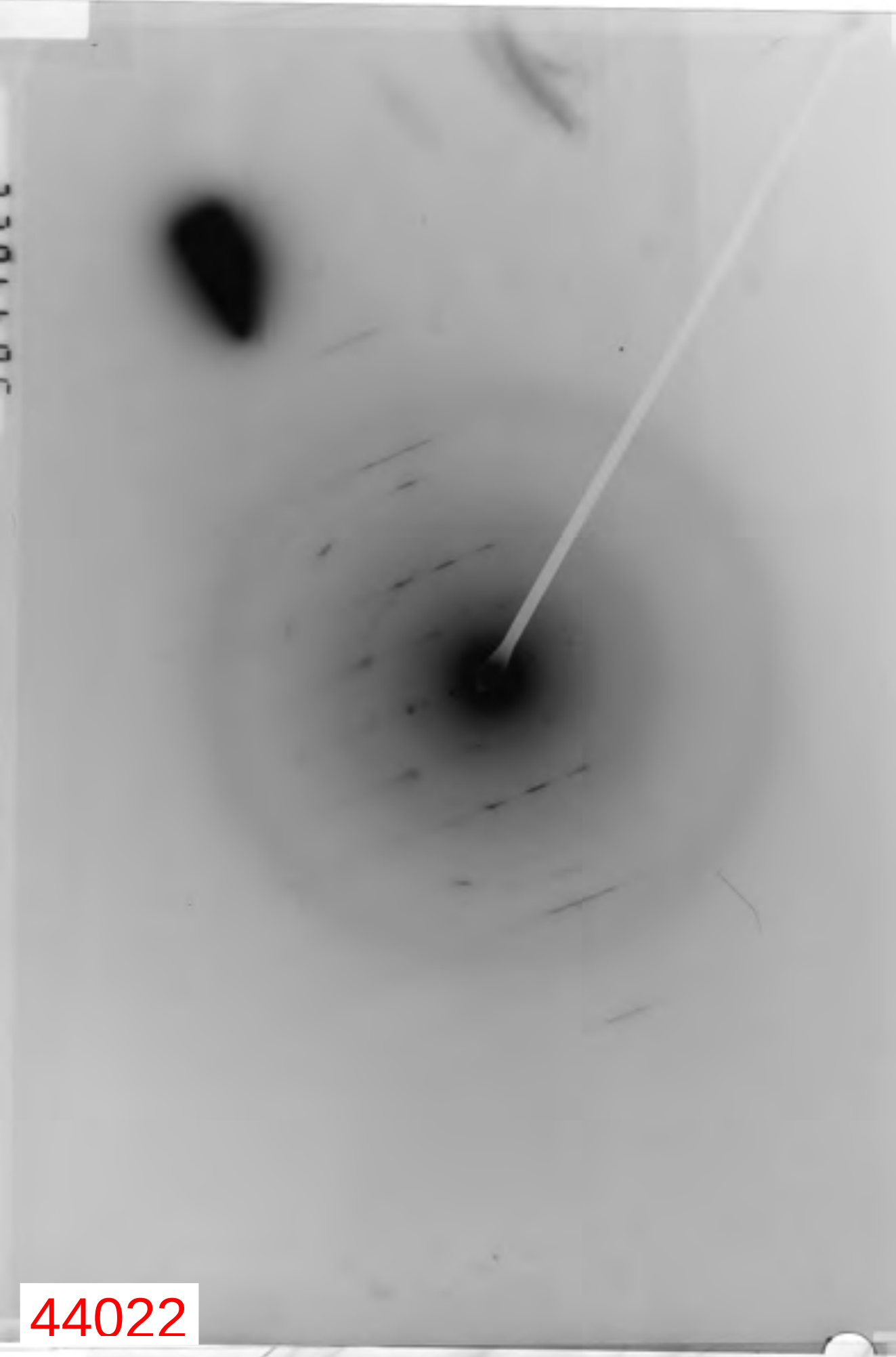
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.56**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



44022

EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43928 SCOPE # 2

Reference / Sample Number: 32

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.54 mm
Mean Distance between spots on Center row (d2): 2.84 mm
Mean distance between spots on slant vector (d1): 9.2 mm

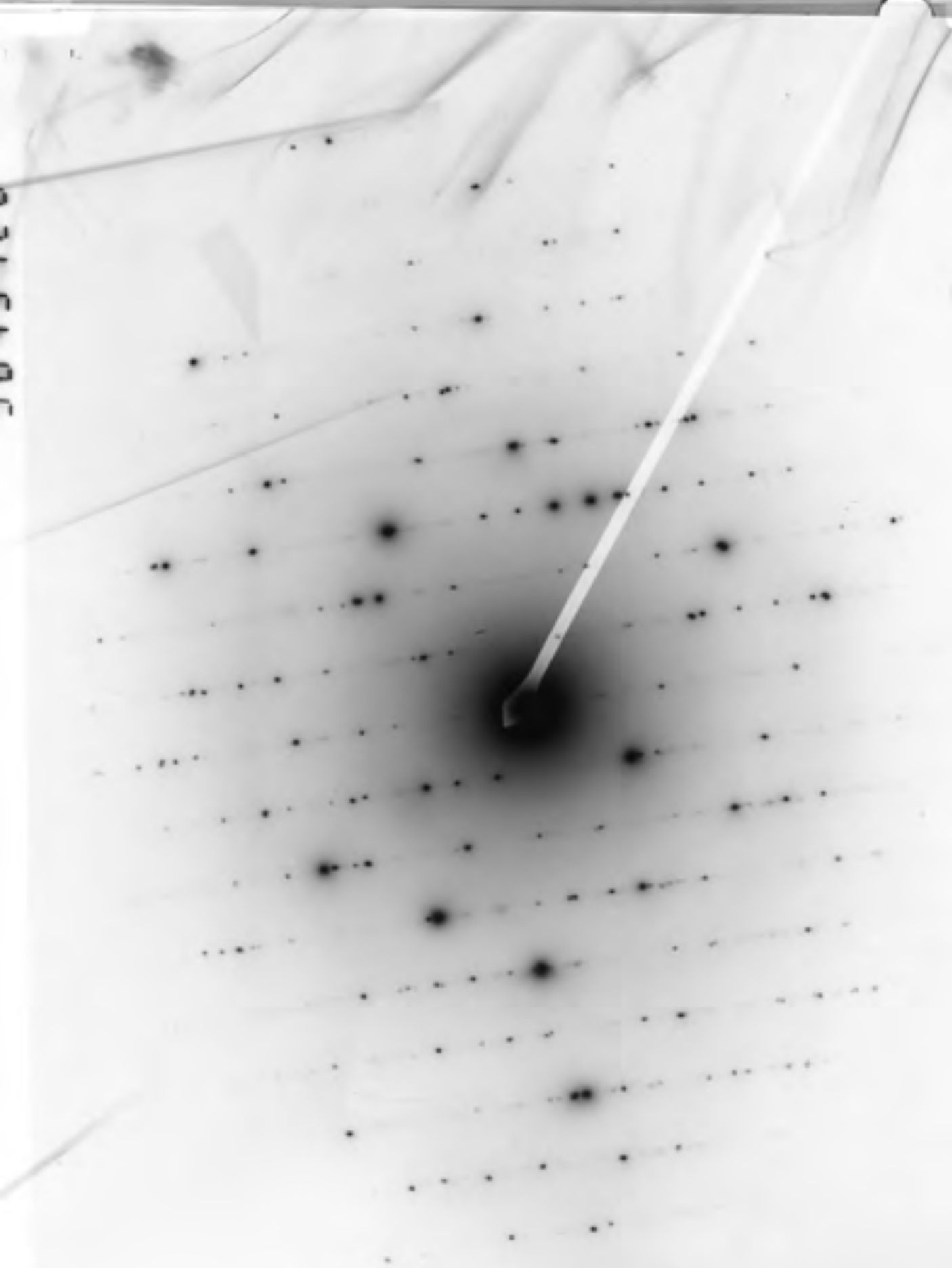
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.26**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**8.41**	8.429	**8.008**	**8.850**
d1 or hk1 (Camera K/slant vector dist.)	**2.60**	2.641	**2.509**	**2.773**
Ratio of hk0/hk1	**3.24**	3.19	**3.031**	**3.350**
Angle of Slant Vector (Measured)	83.0	85.5	**81.225**	**89.775**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [1 1 0]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43928

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0033**	Volume (L):	735	Scope:	09-02
Customer Sample:	HM-AP-HK-05	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	R, 1-3	Analysis Date:	10/4/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 WM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
R1	D1	ND									
R1	D3	ND									
R1	D5	ND									
R1	D7	B	1	1	30.8	4.4	CD	CHRYS		44009	YES
R2	I10	B	2	2	9.5	1.6	CD	CHRYS			
R2	I8	B	3	3	6.8	1.4	CD	CHRYS			
R2	I6	B	4	4	7.1	0.3	CD	CHRYS			
R2	I4	ND									
R3	H1	B	5	5	11.2	0.55	ADX	ACTINOLITE		43929	
R3	H1	B	6	6	25.8	0.9	CD	CHRYS			

ISO 10312

091211943-0033

TEM Asbestos Count Sheet

R3	H1	B	7	7	21	5	ADX	ACTINOLITE			
R3	H1	B	8	8	19.8	3.8	CD	CHRYS			
R3	H3	ND									
R3	H5	B	9	9	12.6	0.3	ADX	ACTINOLITE			YES
R3	H5	B	10	10	11.5	2.4	CD	CHRYS			
R3	H5	B	11	11	9.7	1.9	CD	CHRYS			

ND= None Detected

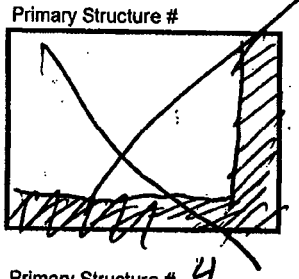
NAM= Non Asbestos Material

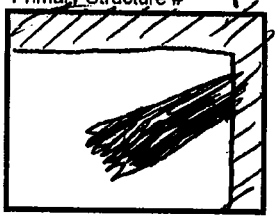
TEM ISO 10312

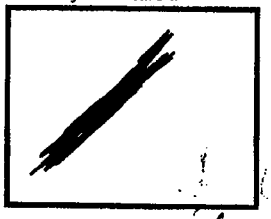
Structure Sketch Sheet

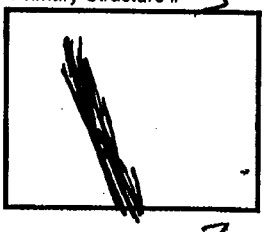
EMSL Order ID: 0912119 43-0033 **Client:**

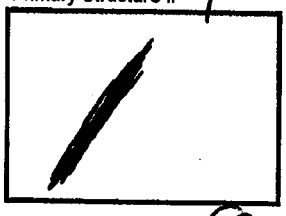
Client Sample: _____ Page 1 of 1

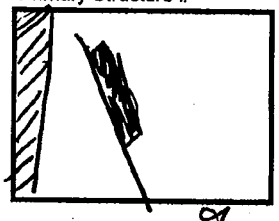
Primary Structure # 

Primary Structure # 1 

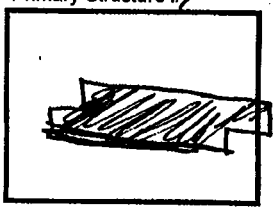
Primary Structure # 2 

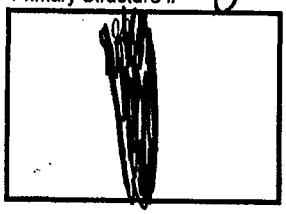
Primary Structure # 3 

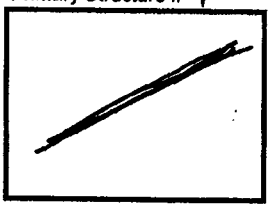
Primary Structure # 4 

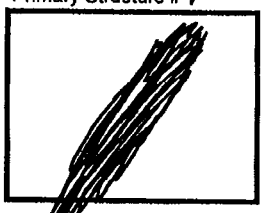
Primary Structure # 5 

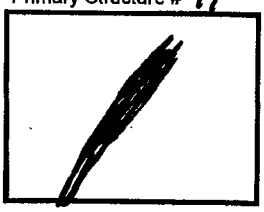
Primary Structure # 6

Primary Structure # 7 

Primary Structure # 8 

Primary Structure # 9 

Primary Structure # 10 

Primary Structure # 11 

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

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Structure #

Structure #

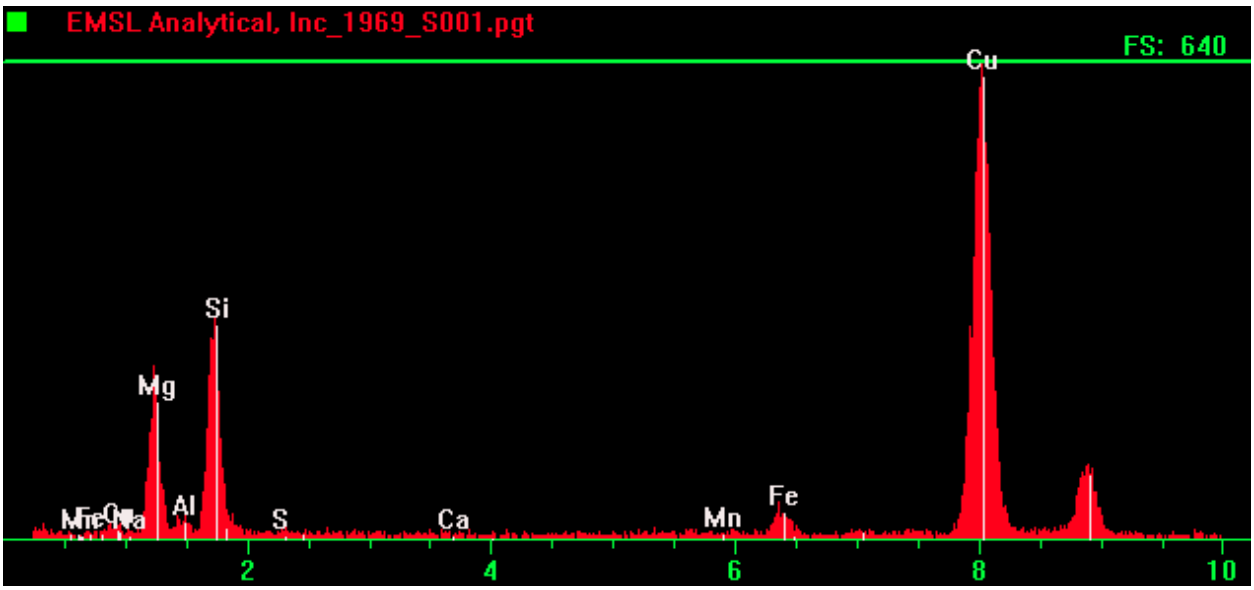
Analyst: KD Date: 4 OCT 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0033_TEM_ISO_10312_EDX_Chrysotile
Collected: October 04, 2012 14:16:46

Live Time:	23.14	Count Rate:	2175	Dead Time:	25.28 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



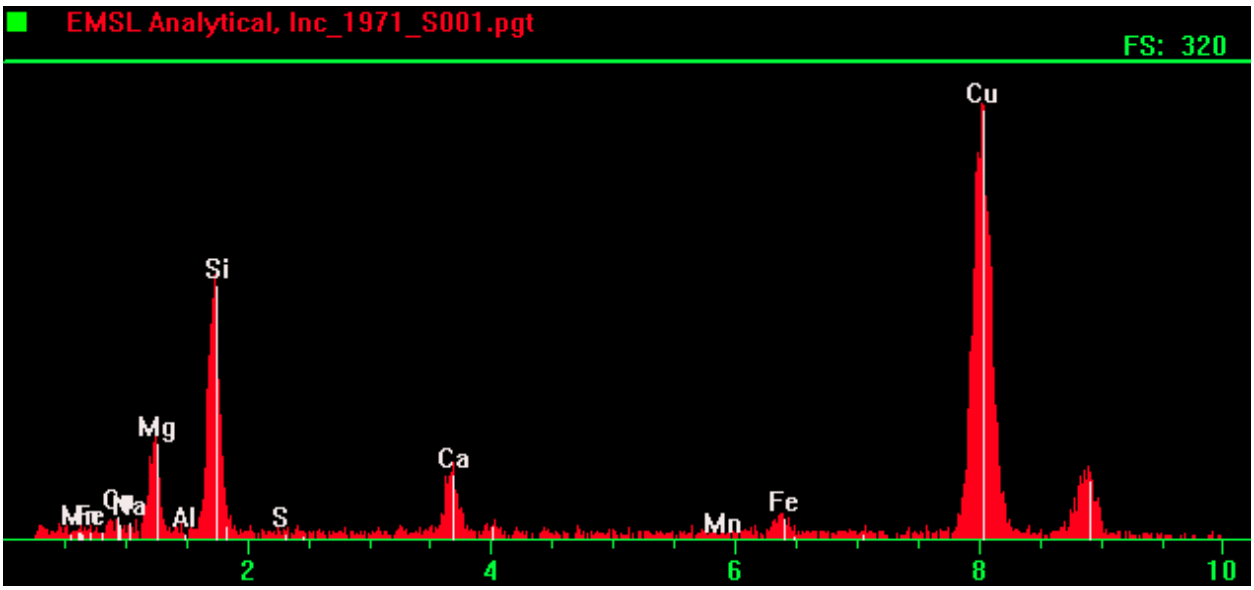
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	8.1	9.3	0.0	0.0
Mg	KA1	157.4	10.7	146.6	13.7
Al	KA1	23.5	10.8	12.7	1.2
Si	KA1	239.9	11.2	228.7	20.4
S	KA1	8.8	8.3	0.5	0.1
Ca	KA1	7.5	6.5	1.1	0.2
Mn	KA1	9.1	9.1	0.0	0.0
Fe	KA1	45.6	9.6	36.0	3.8
Cu	KA1	776.2	11.8	764.4	64.8

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0033_TEM_ISO_10312_EDX_Actinolite
Collected: October 04, 2012 14:59:39

Live Time:	46.61	Count Rate:	551	Dead Time:	8.03 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.3	2.4	0.5	0.2
Mg	KA1	24.3	2.6	21.7	8.4
Al	KA1	2.8	2.7	0.1	0.0
Si	KA1	72.1	2.2	69.9	31.3
S	KA1	2.2	1.7	0.4	0.2
Ca	KA1	22.9	2.6	20.4	7.9
Mn	KA1	2.7	2.3	0.4	0.2
Fe	KA1	8.7	2.4	6.3	2.6
Cu	KA1	182.1	2.5	179.6	71.5

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 44009 SCOPE #: 2

Reference / Sample Number: 33

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.44 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.39**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

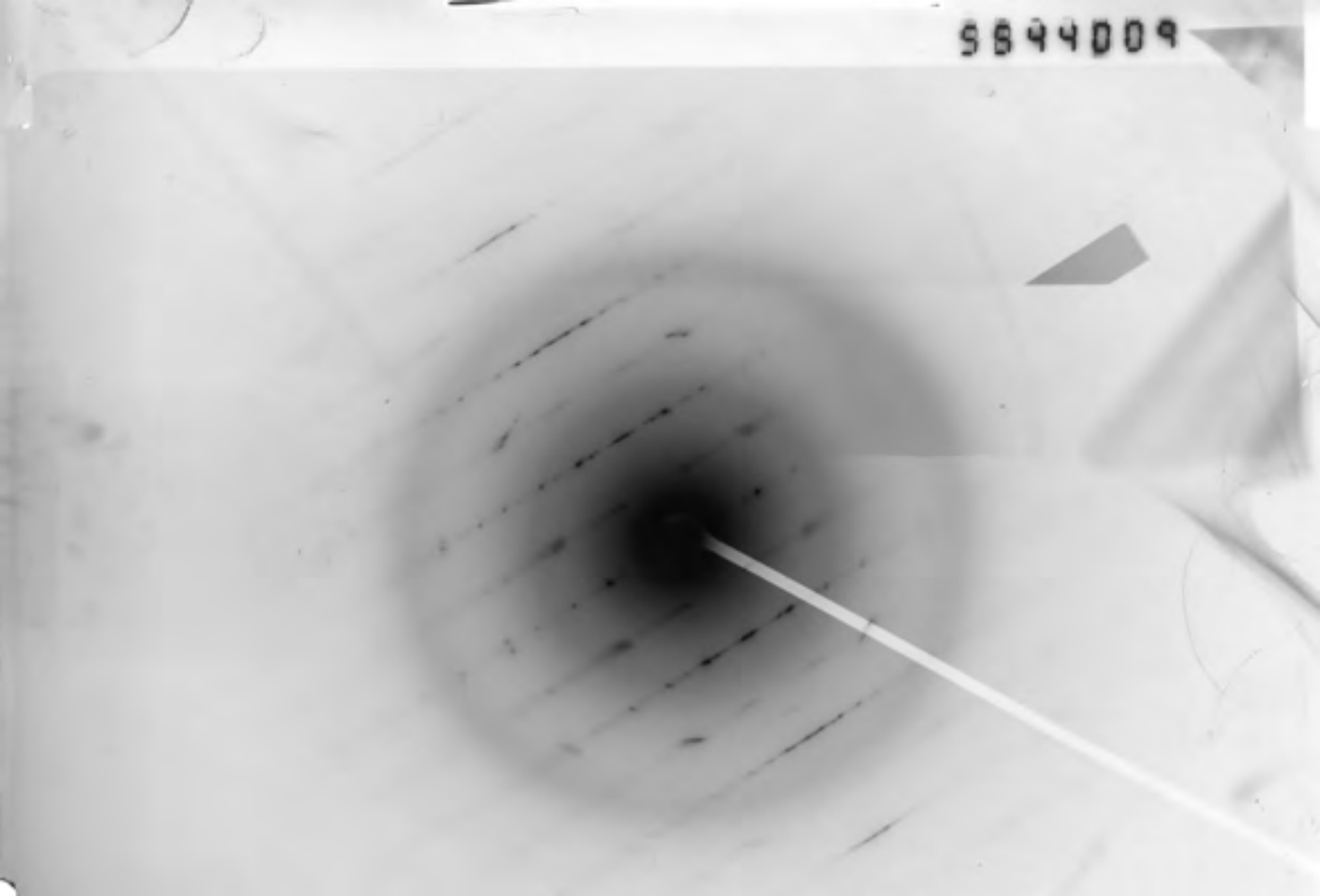
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

S844009



EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43929 SCOPE # 2

Reference / Sample Number: 33

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.5 mm
Mean Distance between spots on Center row (d2): 7.3 mm
Mean distance between spots on slant vector (d1): 6.8 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.31**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**3.27**	3.281	**3.117**	**3.445**
d1 or hk1 (Camera K/slant vector dist.)	**3.51**	3.403	**3.233**	**3.573**
Ratio of hk0/hk1	**0.93**	0.96	**0.912**	**1.008**
Angle of Slant Vector (Measured)	47.0	48.5	**46.075**	**50.925**

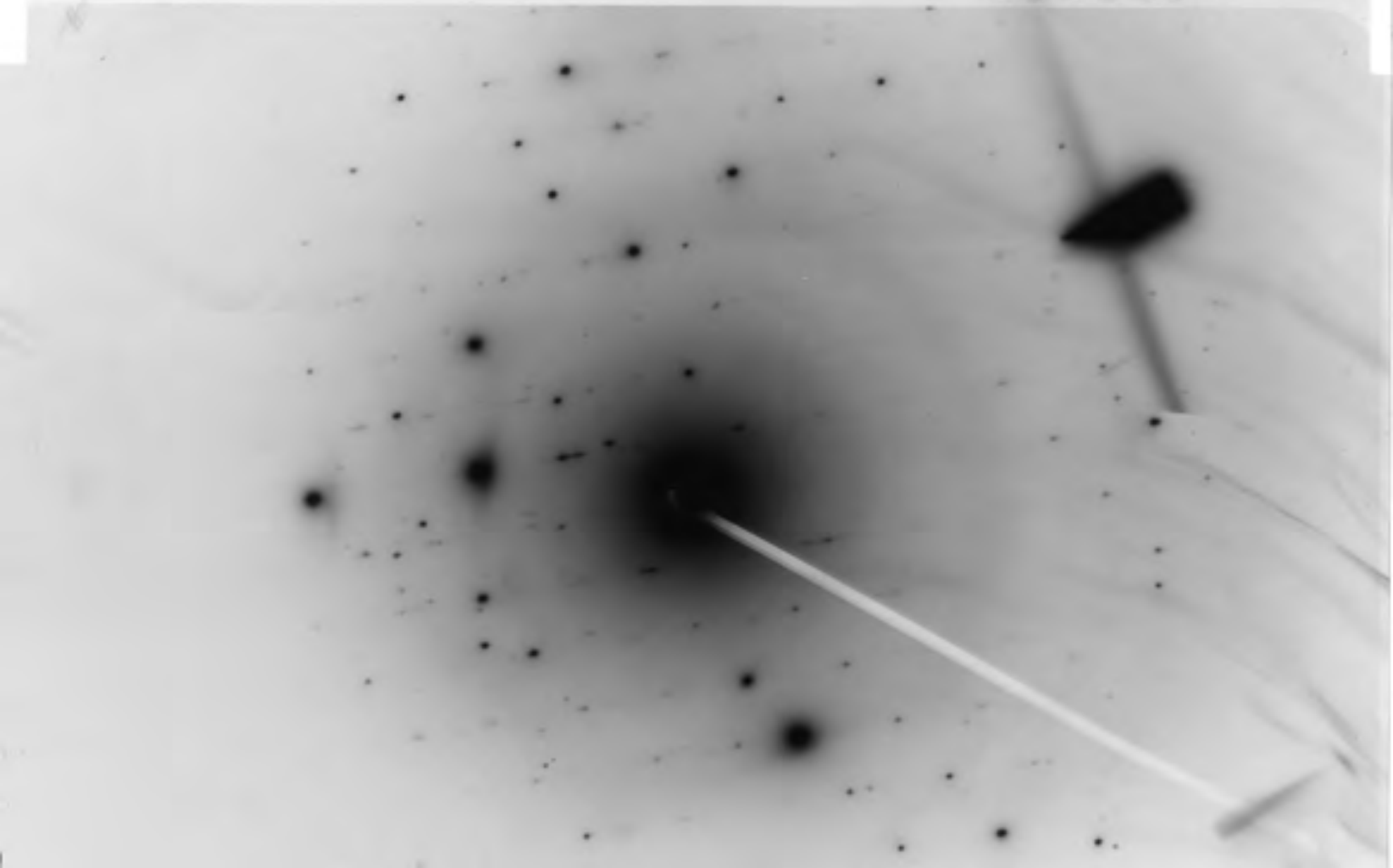
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [2 1 4]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9843929



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0034**	Volume (L):	1925	Scope:	09-02
Customer Sample:	HM-AP-AA-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	R, 4-6	Analysis Date:	10/4/2012

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			
GO Required:	8	none	3:1	5:1	
GO Analyzed:	8				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
R4	E10	B	1	1	6.6	0:4	CD	CHRYS			
R4	E10	B	2	2	6.2	0.65	CD	CHRYS			
R4	E8	ND									
R4	E6	ND									
R5	I1	B	3	3	6.1	0.5	CD	CHRYS		43931	YES
R5	I1	ND									
R5	I3	ND									
R5	I5	ND									
R6	F3	ND									
R6	F5	B	4	4	42	5	CD	CHRYS			

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 0912119213-0034 **Client:**

Client Sample:

Page 1 of 1

Primary Structure # 1

Primary Structure # 2

Primary Structure # 3

12/4/12 DM

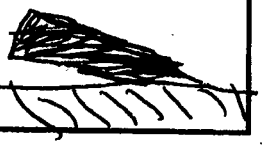
Primary Structure # 4 3

12/4/12 DM

Primary Structure # 5

12/4/12 DM

Primary Structure # 6 4



12/4/12 DM

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

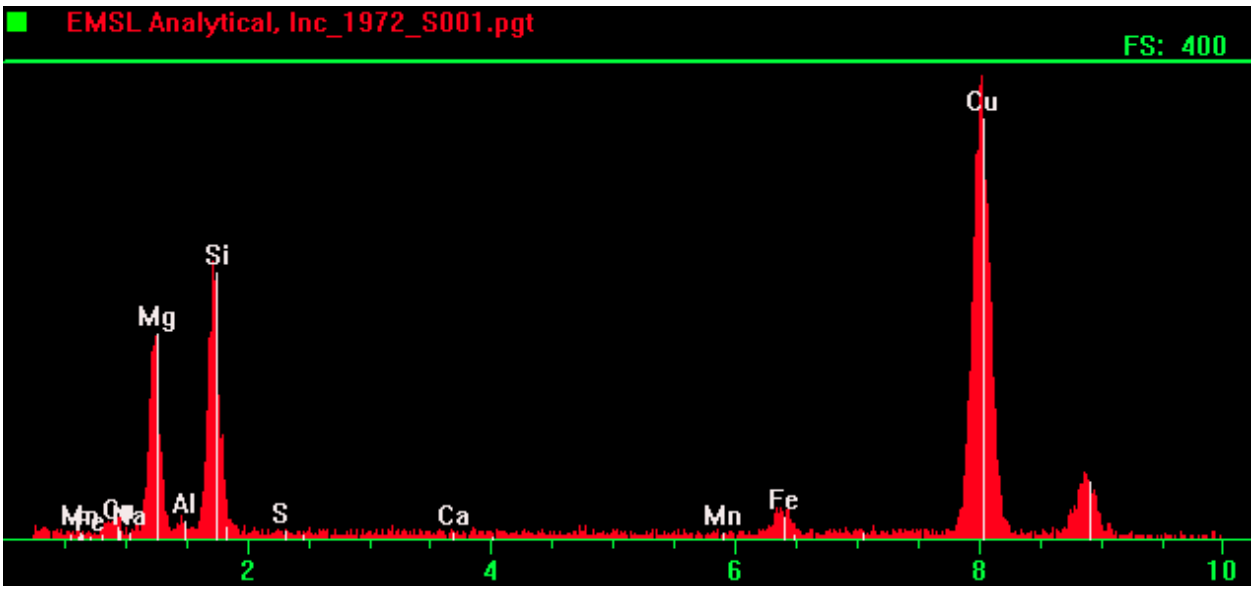
Analyst: KD Date: 4 OCT 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0034_TEM_ISO_10312_EDX_Chrysotile
Collected: October 04, 2012 15:27:20

Live Time:	35.33	Count Rate:	929	Dead Time:	11.39 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.7	3.9	0.0	0.0
Mg	KA1	86.1	4.8	81.3	16.8
Al	KA1	8.4	5.0	3.5	0.7
Si	KA1	120.8	4.8	116.0	24.4
S	KA1	4.7	3.8	0.9	0.2
Ca	KA1	4.5	2.5	2.0	0.8
Mn	KA1	4.3	4.0	0.3	0.1
Fe	KA1	17.8	4.2	13.6	3.2
Cu	KA1	302.6	4.4	298.2	67.5

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43931 SCOPE #: 2

Reference / Sample Number: 34

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.55 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

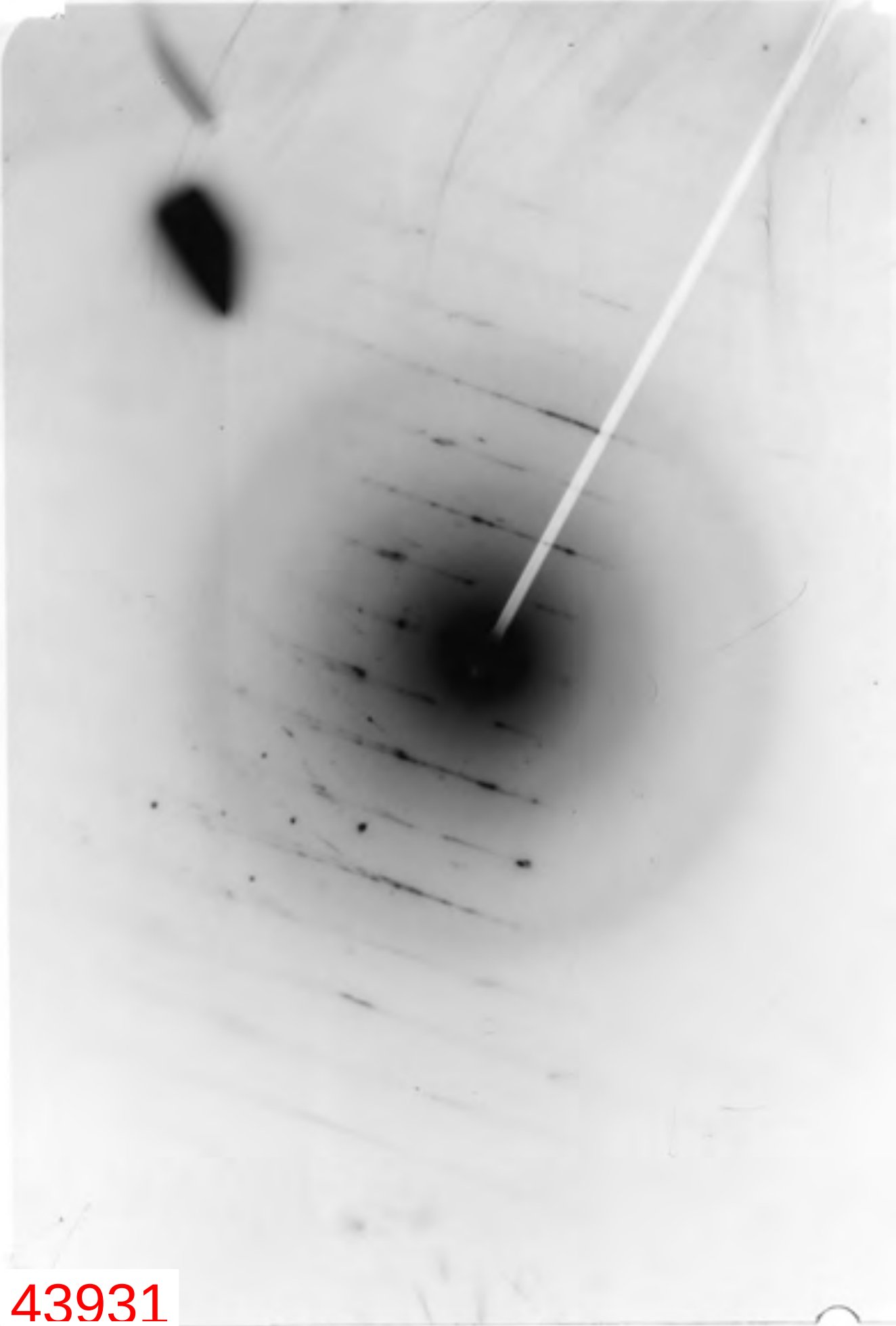
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.26**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43931

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0035**	Volume (L):	1919	Scope:	09-02
Customer Sample:	HM-AP-AA-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	S, 1-3	Analysis Date:	10/4/2012

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	8	none	3:1	5:1	
GO Analyzed:	8				
Level of Analysis Chrysotile:	CDQ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
S1	E10	B	1	1	5.8	1.6	CD	CHRYS			
S1	E8	B	2	2	9.9	2.1	CDQ	CHRYS		43937	YES
S1	E8	B	3	3	6.1	1.1	CD	CHRYS			
S1	E6	B	4	4	14.4	1.1	CD	CHRYS			
S1	E6	B	5	5	17.8	1.8	CD	CHRYS			
S2	E10	B	6	6	64.5	1.2	CD	CHRYS			
S2	E10	MD11	7		11.6	4.8	CD	CHRYS			
S2	E10	MB		7	11.6	1.1	CD	CHRYS			
S2	E8	B	8	8	9.8	1.8	CD	CHRYS			
S2	E8	B	9	9	12.1	3.6	CD	CHRYS			

09121194 3-0035

ISO 10312

11/27/12 DVM

TEM Asbestos Count Sheet

S2	E6	B	10	10	6.8	2.2	CD	CHRYS			
S3	E8	B	11	11	19.8	5	CD	CHRYS			
S3	E8	B	12	12	9.5	2.3	CD	CHRYS			
S3	E6	B	13	13	22.1	3	ADX	ACTINOLITE		43938	YES
S3	E6	B	14	14	16.8	3.8	ADX	ACTINOLITE			
S3	E6	B	15	15	7.8	1.8	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

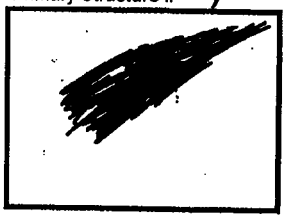
TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 091211943-0035 **Client:**

Client Sample: _____ Page 1 of 1

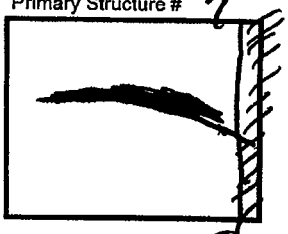
Primary Structure # 1



Primary Structure # 2

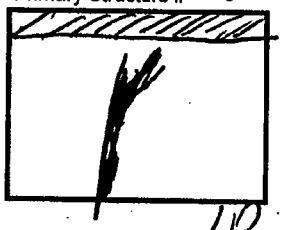
Primary Structure # 3

Primary Structure # 4

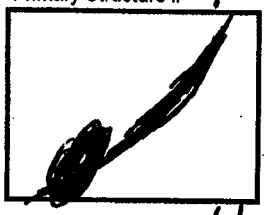


Primary Structure # 5

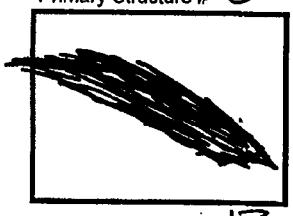
Primary Structure # 6



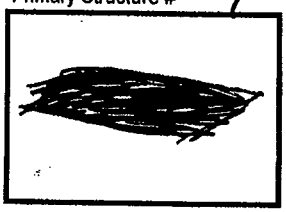
Primary Structure # 7



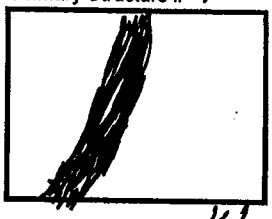
Primary Structure # 8



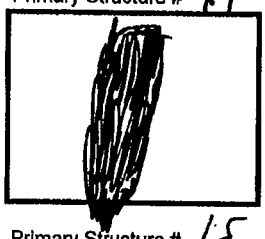
Primary Structure # 9



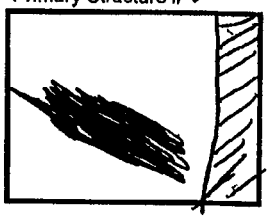
Primary Structure # 10



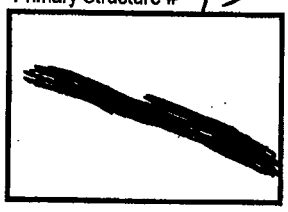
Primary Structure # 11



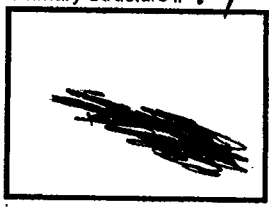
Primary Structure # 12



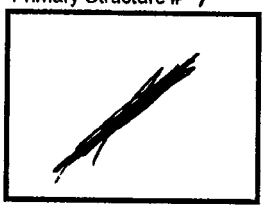
Primary Structure # 13



Primary Structure # 14



Primary Structure # 15



Primary Structure #

Structure #

Structure #

Structure #

Structure #

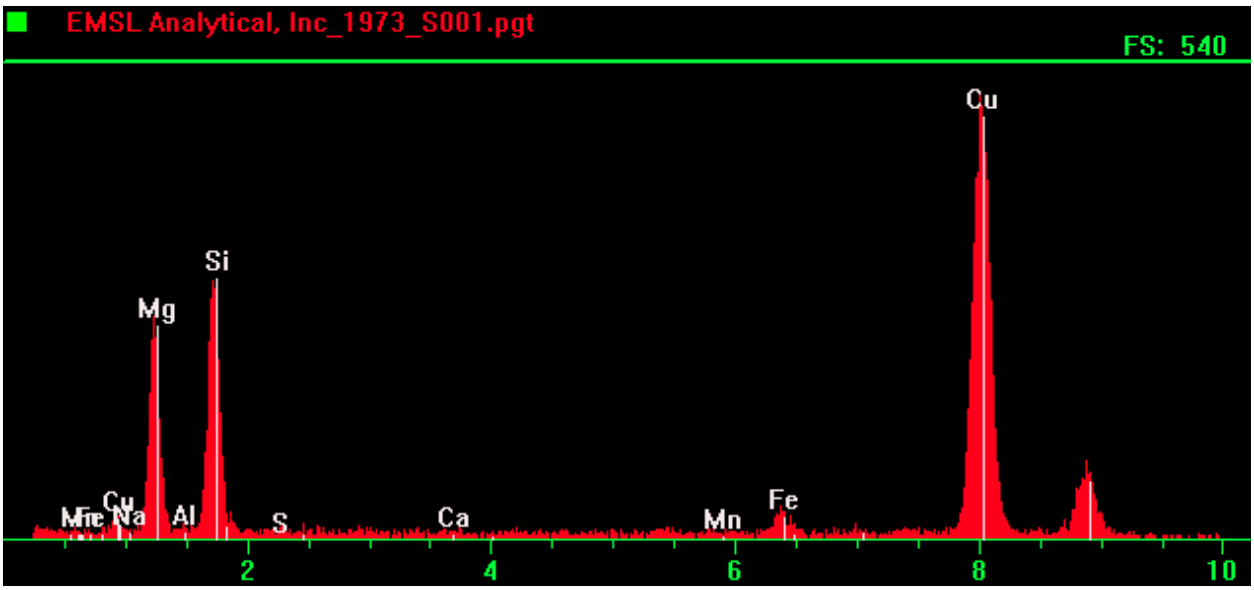
Analyst: KD Date: 4 OCT 12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0035_TEM_ISO_10312_EDX_Chrysotile
Collected: October 04, 2012 16:06:08

Live Time:	46.60	Count Rate:	974	Dead Time:	12.08 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



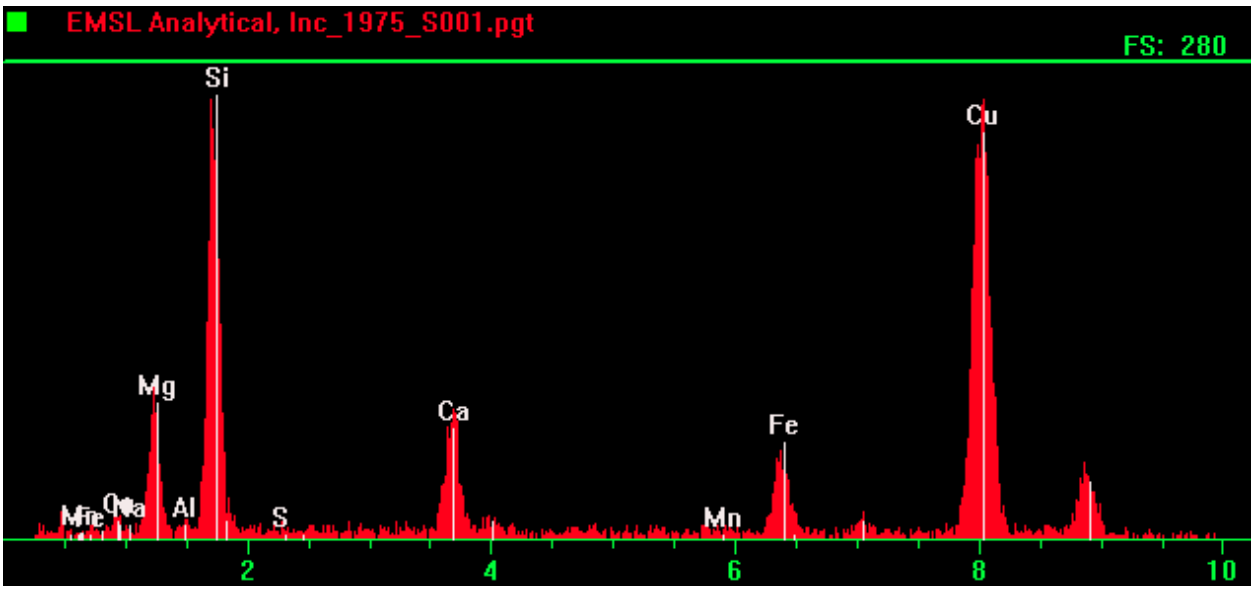
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	4.3	3.5	0.2	0.0
Mg	KA1	92.2	4.1	88.1	21.4
Al	KA1	6.6	4.8	1.8	0.4
Si	KA1	125.2	4.9	120.3	24.6
S	KA1	4.7	4.1	0.7	0.2
Ca	KA1	4.7	3.2	1.5	0.5
Mn	KA1	5.1	4.5	0.6	0.1
Fe	KA1	18.5	4.8	13.6	2.9
Cu	KA1	309.5	5.0	304.5	60.6

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0035_TEM_ISO_10312_EDX_Actinolite
Collected: October 04, 2012 16:42:31

Live Time:	33.71	Count Rate:	864	Dead Time:	10.42 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	4.1	3.5	0.1	0.0
Mg	KA1	42.9	3.9	39.0	10.0
Al	KA1	5.8	4.5	1.3	0.3
Si	KA1	149.1	4.7	144.4	30.6
S	KA1	4.3	3.2	1.1	0.3
Ca	KA1	51.4	3.6	47.9	13.4
Mn	KA1	4.7	3.1	1.6	0.5
Fe	KA1	36.9	3.3	33.5	10.2
Cu	KA1	222.5	4.6	217.8	47.1

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 35 SCOPE #: 2

Reference / Sample Number: 43937 11/27/12 MM

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.58 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.35	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.22**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.14**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

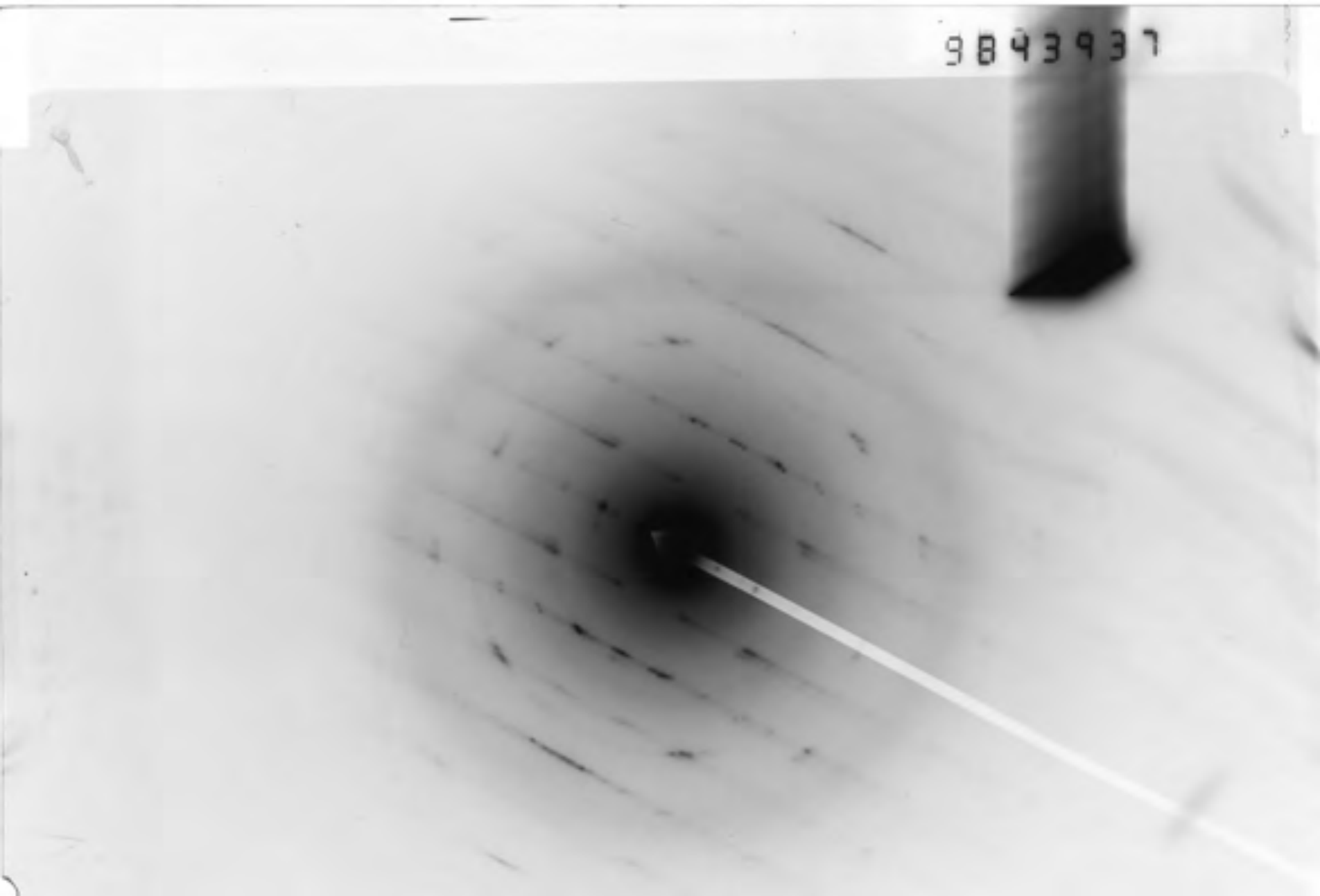
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9843937



EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43938 SCOPE # 2

Reference / Sample Number: 35

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.52 mm
Mean Distance between spots on Center row (d2): 4.725 mm
Mean distance between spots on slant vector (d1): 4.75 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.29**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**5.06**	5.099	**4.844**	**5.354**
d1 or hk1 (Camera K/slant vector dist.)	**5.03**	4.931	**4.684**	**5.178**
Ratio of hk0/hk1	**1.01**	1.03	**0.979**	**1.082**
Angle of Slant Vector (Measured)	67.0	68.0	**64.600**	**71.400**

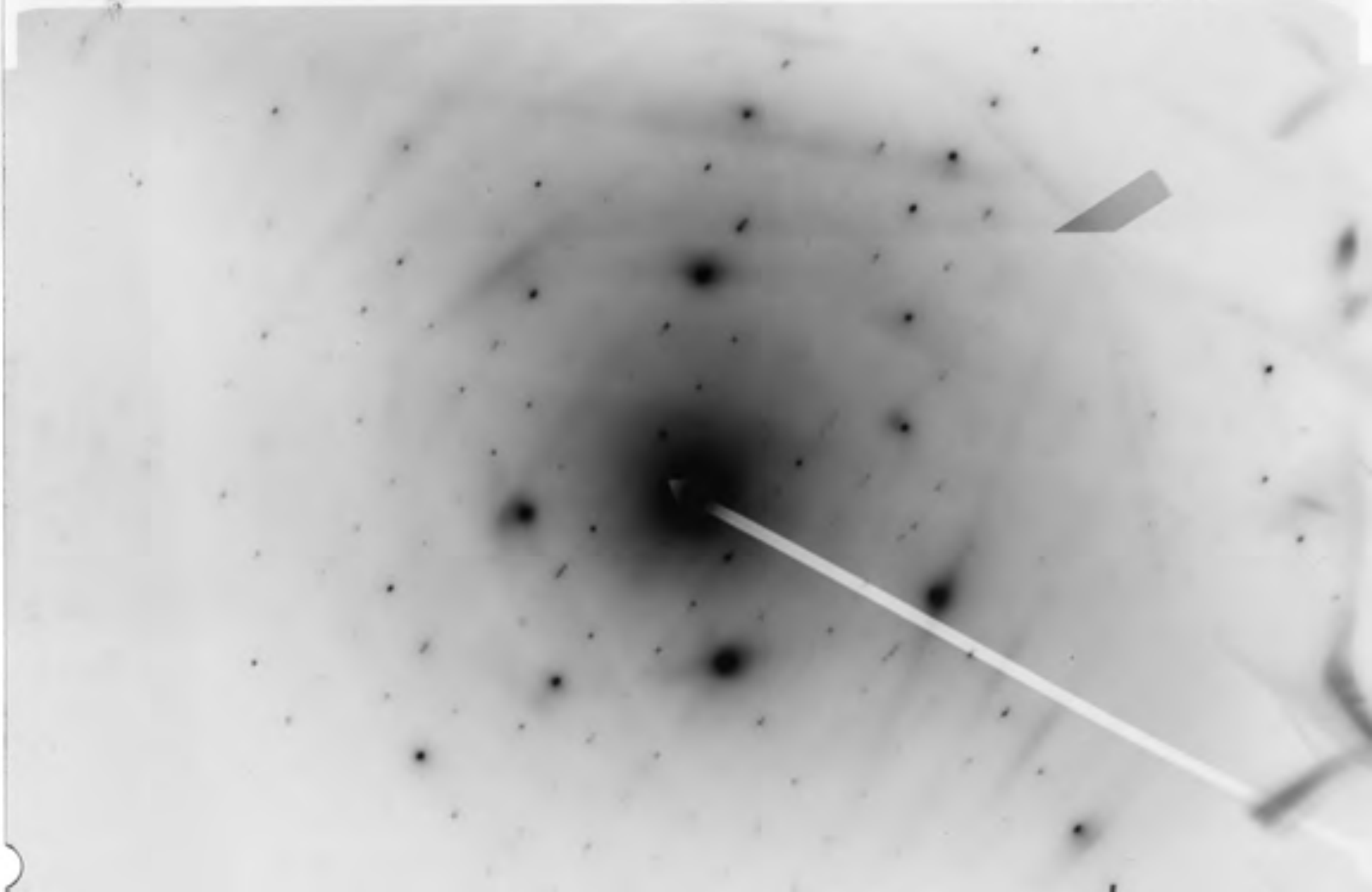
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [3 1 2]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

5543938



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0036**	Volume (L):	673	Scope:	09-02
Customer Sample:	HM-OP-ATV-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	S, 4-6	Analysis Date:	10/4/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	12	none	3:1	5:1	
GO Analyzed:	0				OVERLOADED
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 JM	Min Length:	> 5	micron	Blown Out
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0036	Volume (L):	673	Scope:	04-03
Customer Sample:	HM-OP-ATV-01	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box:	0412- ~~121001~~ ERRG -01 11/29/12 pm	Analyzed By:	PHarrison
EFA (mm²):	385	Grid Location:	~~S, 4-8~~ PH 11/29/12 E, 5-8	Analysis Date:	11/13/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		**Comments:**
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Q~~ 11/29/12 pm		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
E5	A4	MD11	1		11.4	2.8					
		MF		1	11.4	0.8	ADX	AC		03534	1
		B	~~Q~~ 2 PH 11/29/12	~~Q~~ 2	32.0	3.0	CD	CH		03535	1
		F	0	0	7.7	0.3	ADX	AC			
	C5	NSD									
	D7	B	0	0	12.5	1.5	CD	CH			
		MD11	0		12.0	11.0					
		MF		0	5.2	0.4	NAM	NRA		03536	1
		MD11	3		~~Q~~ PH 11/29/12 11.5	3.2					
		MB		3	11.0	0.5	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0036**	Volume (L):	673	Scope:	04-03
Customer Sample:	HM-OP-ATV-01	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412 – ~~121001~~ 121201	Analyzed By:	J Hamson
EFA (mm^2):	385	Grid Location:	~~S, 4-6~~ E, 5-8 (PK 11/13/12)	Analysis Date:	11/13/12

11/29/12 DM

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Q~~ (11/29/12 DM)		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	Total	Length	Width					
E5	D7	B	4	4	19.5	2.6	CD	CH			
↓	E2	MDU	5		27.5	16.0					
↓	↓	MF		5	27.0	1.0	ADX	AL			
↓	↓	B	6	6	10.6	2.0	CD	CH			
↓	G3	B	7	7	10.7	1.0	CD	CH			
↓	I10	ND									
E6	J2	MDU	6		15.0	10.0					
↓	↓	MB		6	7.5	1.0	CD	CH			
↓	H3	ND									
↓	G6	B	0	0	12.3	1.3	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0036**	Volume (L):	673	Scope:	04-03
Customer Sample:	HM-OP-ATV-01	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412- ~~121001~~ ERRG7-01 11/29/12 om	Analyzed By:	PHarrison
EFA (mm^2):	385	Grid Location:	~~S, 4-6~~ E, 5-8 PK 11/13/12	Analysis Date:	11/13/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CDØ 11/29/12 om		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
E6	G6	B	9	9	20.0	2.1	CD	CH			
	↓	B	10	10	13.0	1.0	CD	CH			
	F2	B	11	11	5.5	0.7	CD	CH			
	↓	B	12	12	32.0	4.0	CD	CH			
	D7	B	13	13	14.0	2.0	CD	CH			
	A3	ND									

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

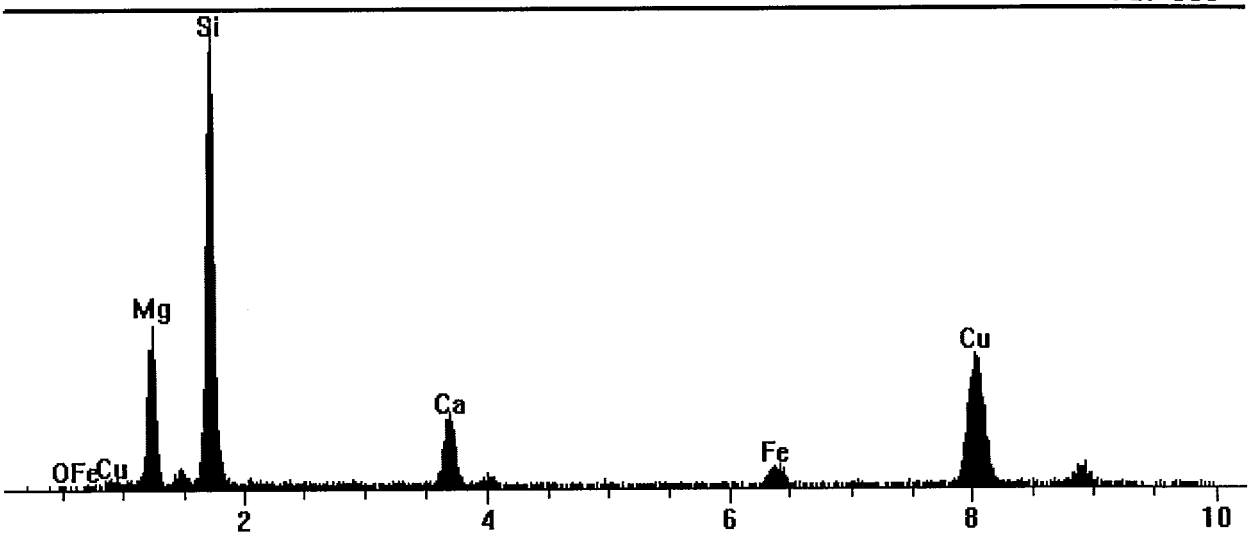
EMSL ANALYTICAL, INC.

File: L:\EDS Spe...Spectra\Scope 04-03\2012\091211943-0036 E5 A4 1 AC.pgt
Collected: November 13, 2012 09:25:36

Live Time:	40.80	Count Rate:	1145	Dead Time:	19.97 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	28964.73				

091211943-0036 E5 A4 1 AC.pgt

FS: 900



Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.7800	19.86	18.16	26.2	MgO	32.92
Si	KA1	1.740	1.0000	33.05	26.17	37.7	SiO	51.87
Ca	KA1	3.691	1.2000	7.84	4.35	6.3	CaO	10.98
Fe	KA1	6.403	1.6100	3.29	1.31	1.9	FeO	4.23
Cu	KA1	8.046	0.0000	0.00	0.00	0.0		
O	KA1	0.523	0.0000	35.96	50.00	72.0		
Total			**0.0000**	**100.00**	**100.00**	**144.0**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	104.1	5.7	98.3
Si	KA1	297.9	6.5	291.3
Ca	KA1	63.1	5.5	57.6
Fe	KA1	22.8	4.8	18.0
Cu	KA1	164.2	5.1	159.1
O	KA1	1.9	1.8	0.1

Energy Dispersive X-Ray Analysis Quantitative Spectra & Data

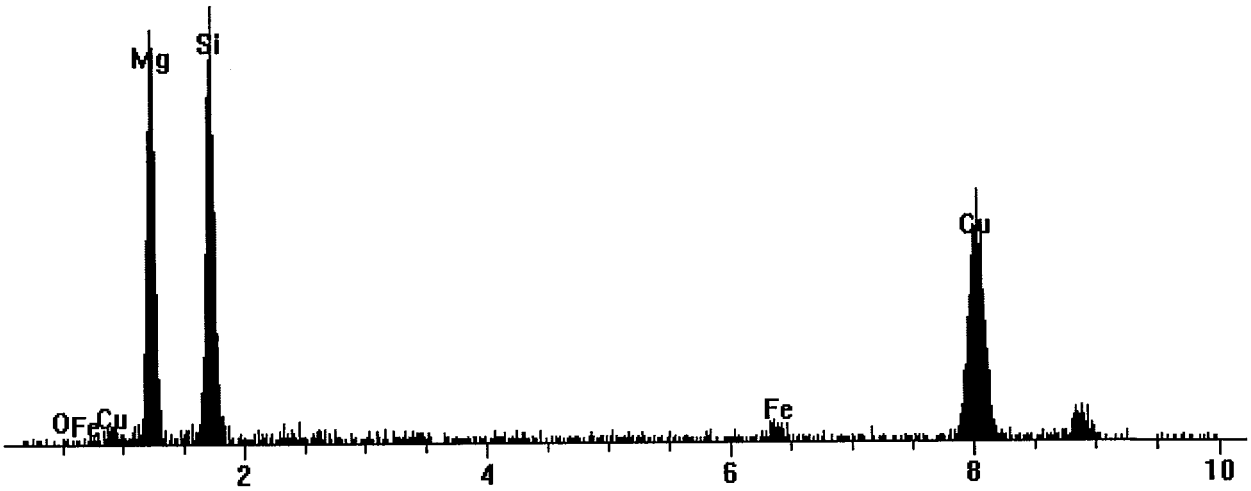
EMSL ANALYTICAL, INC.

File: L:\EDS Spe...Spectra\Scope 04-03\2012\091211943-0036 E5 A4 2 CH.pgt
Collected: Nov 13, 2012 10:05:03

Live Time:	88.92	Count Rate:	120	Dead Time:	2.46 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	35860.57				

■ 091211943-0036 E5 A4 2 CH.pgt

FS: 180



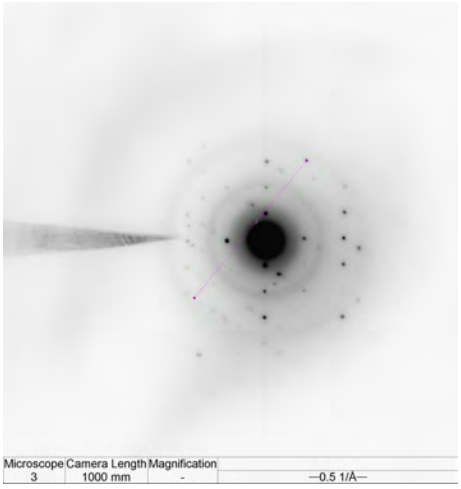
Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.0026	10.54	12.96	18.6	MgO	17.48
Si	KA1	1.740	1.0000	12.15	12.94	18.5	SiO	19.07
Fe	KA1	6.403	2.6697	1.84	0.99	1.4	Fe2O3	2.64
Cu	KA1	8.046	3.7835	48.58	22.86	32.8	CuO	60.81
O	KA1	0.523	0.0000	26.88	50.25	72.0		
Total			**0.0000**	**100.00**	**100.00**	**143.3**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	21.4	0.6	20.8
Si	KA1	24.7	0.6	24.0
Fe	KA1	1.7	0.4	1.4
Cu	KA1	25.8	0.4	25.4
O	KA1	0.5	0.3	0.2

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number:	091211943	**Date:**	Nov 13, 2012
Image Number:	03534		
Reference / Sample Number:	0036		
Preliminary ID:	ACTINOLITE		
Camera Constant:	1.937e-003	**1/A Pixels**	
Calibration Reference:	111212-04-03-03533_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.171**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**N/A**	N/A	**-**	**-**
d1 or hkl (Camera K/slant vector dist.):	**N/A**	N/A	**-**	**-**
Ratio of hk0/hkl:	**N/A**	N/A	**-**	**-**
Vector Angle:	**N/A**	N/A	**-**	**-**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: [**N/A**]

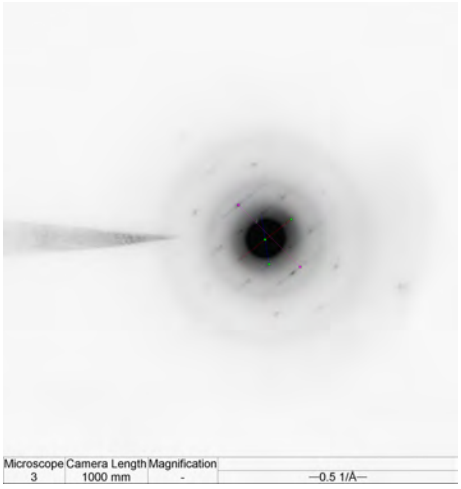
Preliminary Identification was:

X	CORRECT
	INCORRECT

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number:	091211943	**Date:**	Nov 13, 2012
Image Number:	03535		
Reference / Sample Number:	0036		
Preliminary ID:	Chrysotile		
Camera Constant:	1.9366629	**1/A Pixels**	
Calibration Reference:	111212-04-03-03533_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.244**	5.3	**5.06**	**5.56**
Vector Angle:	**59.1**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.053**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.516**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0037**	Volume (L):	616	Scope:	09-02
Customer Sample:	HM-OP-ATV-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	T, 1-3	Analysis Date:	10/4/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	9	none	3:1	5:1	OVERLOADED
GO Analyzed:	0				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0037**	Volume (L):	616	Scope:	04 01
Customer Sample:	HM-OP-ATV-02	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121001~~ 0412-ERRG-01	Analyzed By:	FCRAIG
EFA (mm^2):	385	Grid Location:	~~I, 13~~ F 1-4 11/29/12 DM	Analysis Date:	11/9/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	9		none	3:1	5:1
GO Analyzed:	9				
Level of Analysis Chrysotile:	CD		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥ 0.25	micron

Comments:
25% PART LOADING
VERTICAL TO

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F2	D7	MD11	1		13	3.5					
		MB		1	13	3.5	CD	CH			1
		MD11	2		13	10.5					
		MB		2	13	1.7	CD	CH			
		MD21	3		10	6					
		MB		3	6.5	.7	CD	CH			
		MR10		0			NAM	NAM			
		MD11	4		26	2.5					
		MF		4	26	1.25	ADX	ACT		011394	1
	B10	MC11	5	5	~~15~~ 16	15	ADX	ACT			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0037**	Volume (L):	616	Scope:	04 01
Customer Sample:	HM-OP-ATV-02	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:		Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121001~~ 0412-ERRG-01	Analyzed By:	FCRAIG
EFA (mm^2):	385	Grid Location:	~~I, 13~~ F 1-4 11/29/12 DM	Analysis Date:	11/9/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	9		none	3:1	5:1
GO Analyzed:	9				
Level of Analysis Chrysotile:	CD		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥ 0.25	micron

Comments:
25% PART LOADING
VERTICAL TO

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F2	B10	MD11	6		17.5	5					
		MB		6	17.5	2.8	CD	CH		011396	
	E9	MD11	0		24.5	7					
		MB		0	24.5	3	CD	CH			
		MC11	7	7	33.5	31	ADX	ACT			
		MD11	8		11.25	9					
		MF		8	9.3	.75	ADX	ACT			
	G6	MC11	9	9	36	18.5	ADX	ACT			
	I8	MC11	10	10	33	15.5	CD	CH			
		B	11	11	8.5	1.3	CD	CH			

ISO 10312

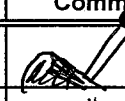
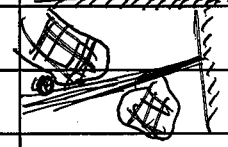
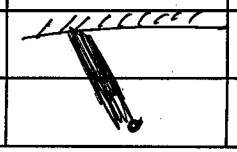
TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0037**	Volume (L):	616	Scope:	04 01
Customer Sample:	HM-OP-ATV-02	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:		Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121001~~ 0412-ERR(n-01	Analyzed By:	FCRAIG
EFA (mm^2):	385	Grid Location:	~~I, 13~~ F 1-4 11b9lb 0m	Analysis Date:	11/9/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	9		none	3:1	5:1
GO Analyzed:	9				
Level of Analysis Chrysotile:	CD		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥ 0.25	micron

Comments:
25% PART LOADING
VERTICAL TO

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F2	I8	MC11	12	12	27	12.8	ADX	ACT			
F3	H9	MD11	13		18	12					
		MB		13	7.2	.8	CD	CH			
		MC11	14	14	12.5	12.25	ADX	ACT			
		MD11	15		46	35					
		MB		15	46	2.5	CD	CH			
	F7	ND									
	D6	ND									
	B9	MD11	0		6.8	2.2					
		MB		0	6.2	1.6	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

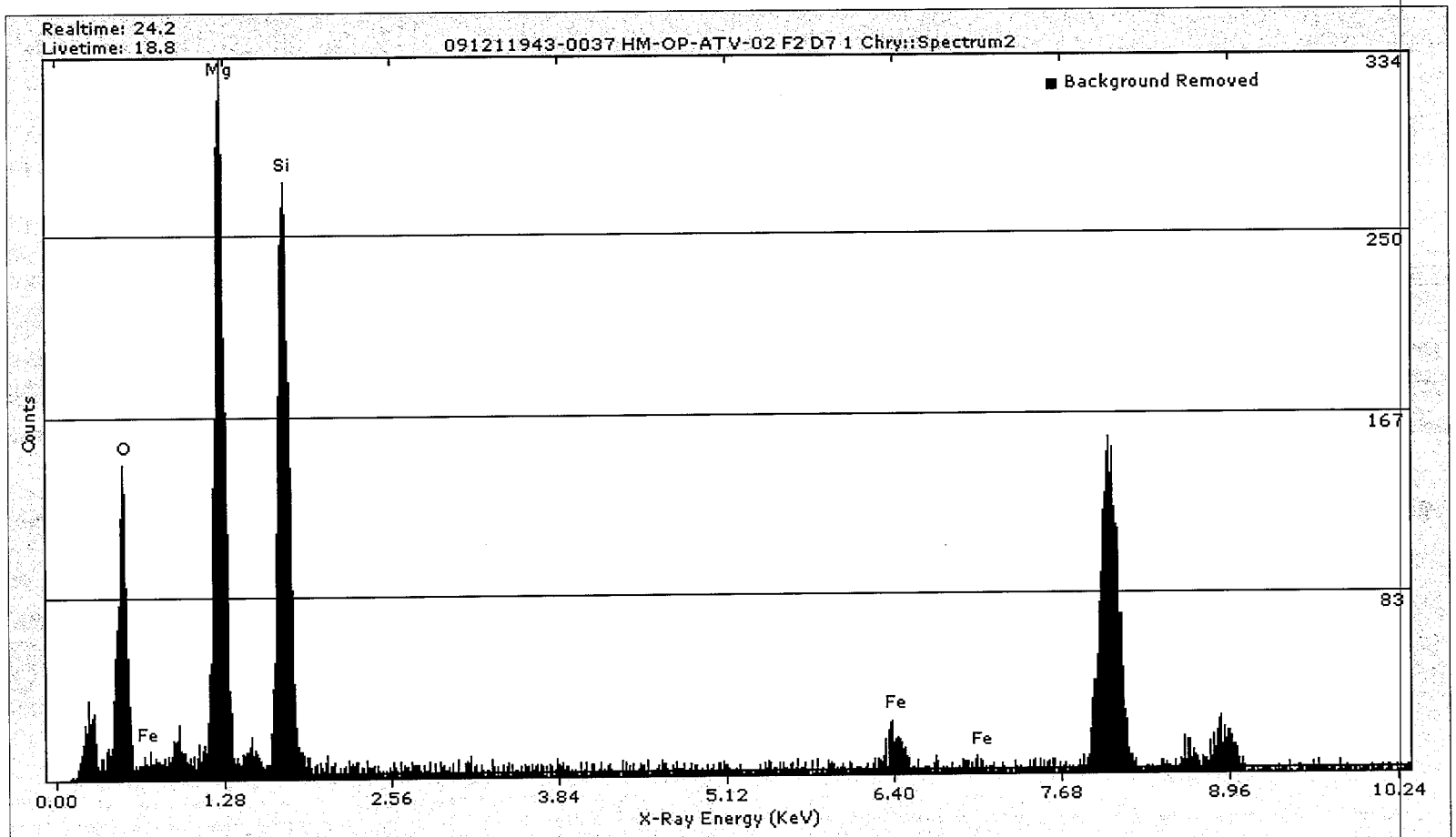
EMSL Sample ID:	**091211943-0037**	Volume (L):	616	Scope:	04 01
Customer Sample:	HM-OP-ATV-02	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:		Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121001~~ 0412-ERRG2-01	Analyzed By:	FCRAIG
EFA (mm^2):	385	Grid Location:	~~I, 13~~ F 1-4 11/12/12 DM	Analysis Date:	11/9/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	9		none	3:1	5:1
GO Analyzed:	9				
Level of Analysis Chrysotile:	CD		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥ 0.25	micron

Comments:
25% PART LOADING
VERTICAL TO

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F3	B9	MD11	16		20	18					
		MF		16	18	1	ADX	ACT			



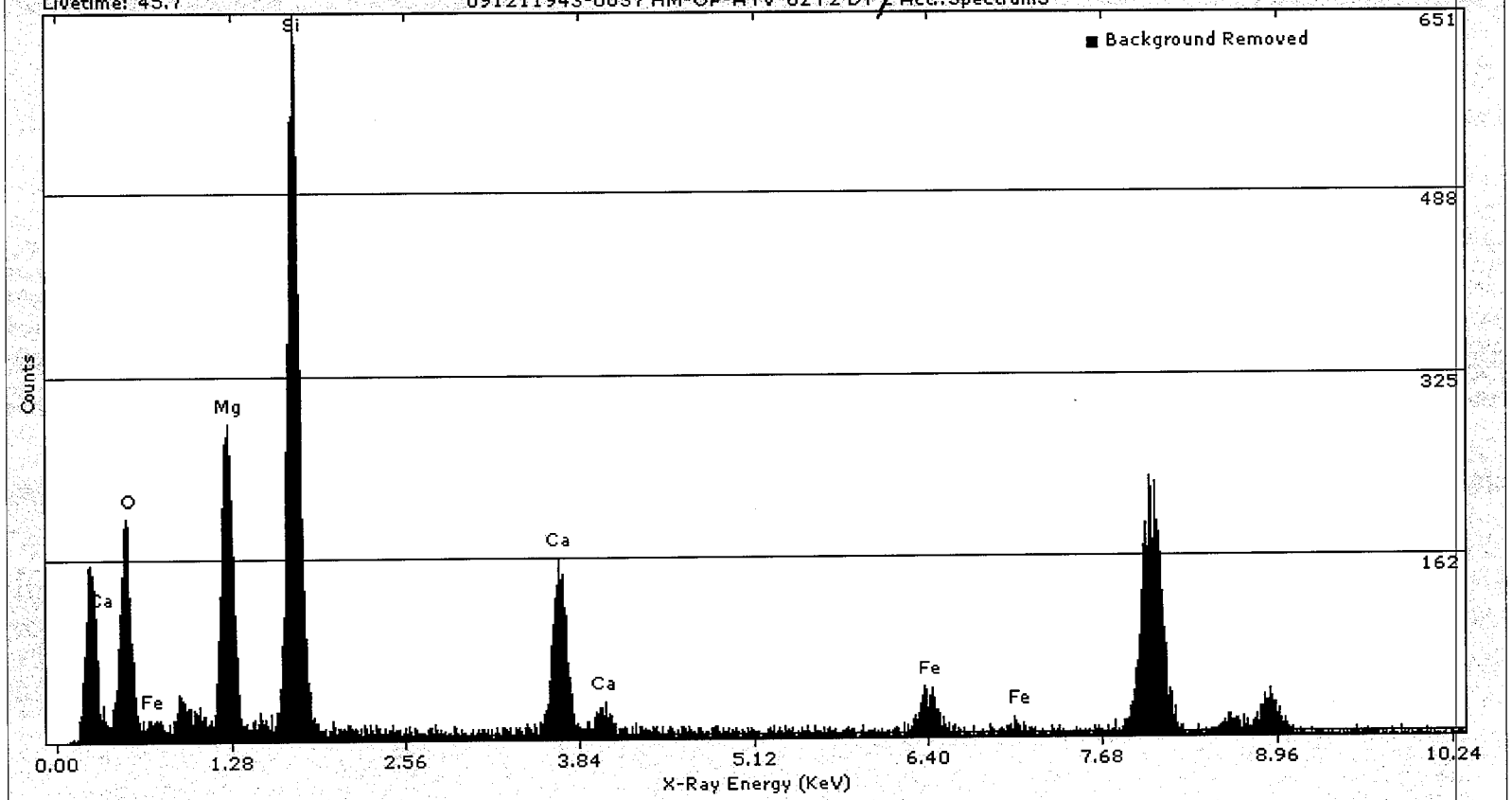
Quantitative Results for Spectrum2
Analysis: Thin Film Method: Standardless
Acquired 09-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.26	0.97	58.54	0.00		0.0000	0.0	85.8	959.43
Magnesium	28.68	0.60	23.89	47.56	(MgO)	0.4151	2281.7	95.5	2394.57
Silicon	23.68	0.50	17.07	50.66	(SiO2)	0.3190	2196.8	101.4	2317.33
Iron	1.38	0.03	0.50	1.77	(FeO)	0.0123	105.6	146.1	193.34
Total	100.00			100.00					

4 11/29/12 pm

Realtime: 56.8
Livetime: 45.7

091211943-0037 HM-OP-ATV-02 F2 D7 Act::Spectrum3



Quantitative Results for Spectrum3
Analysis: Thin Film Method: Standardless
Acquired 09-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.22	0.65	60.73	0.00		0.0000	0.0	85.8	1468.30
Magnesium	14.76	0.21	12.77	24.47	(MgO)	0.2452	2214.2	95.5	2242.43
Silicon	28.66	0.40	21.45	61.31	(SiO2)	0.4451	5014.2	101.4	5176.59
Calcium	7.78	0.11	4.08	10.89	(CaO)	0.0685	1416.4	122.2	1497.35
Iron	2.58	0.04	0.97	3.33	(FeO)	0.0202	373.7	146.1	432.24
Total	100.00			100.00					

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 09, 2012

Image Number: 011394

Sample Number: 0037-04-01

Preliminary ID: Actinolite

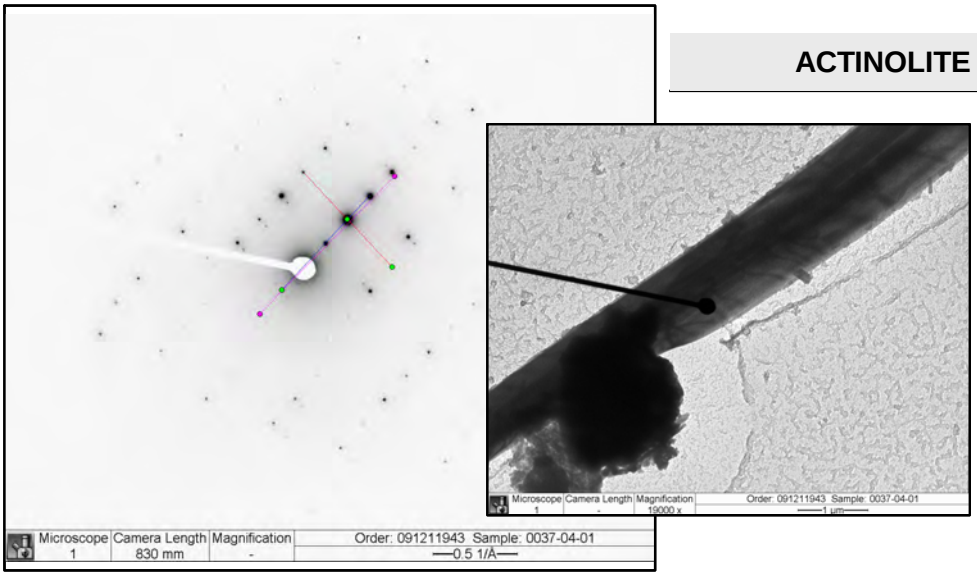
Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.274**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**2.507**	2.497	**2.372**	**2.622**
d1 or hkl (Camera K/slant vector dist.):	**5.156**	5.158	**4.900**	**5.416**
Ratio of hk0/hkl:	**0.486**	0.484	**0.460**	**0.508**
Vector Angle:	**86.3**	86.140	**81.833**	**90.447**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: [**-7 -1 0**]



Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 09, 2012

Image Number: 011396

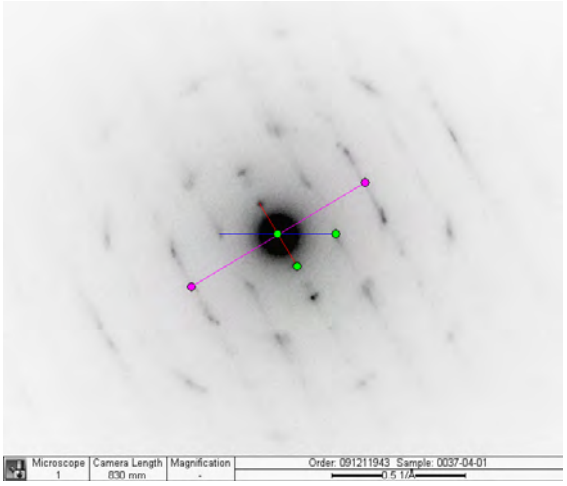
Reference / Sample Number: 0037

Preliminary ID: Chrysotile

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.281**	5.3	**5.06**	**5.56**
Vector Angle:	**59.0**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.262**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.609**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

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ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0038**	Volume (L):	695	Scope:	09-02
Customer Sample:	HM-OP-ATV-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	T, 4-6	Analysis Date:	10/4/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	11	none	3:1	5:1	OVERLOADED
GO Analyzed:	0				25%
Level of Analysis Chrysotile:	CD~~Q~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0038**	Volume (L):	695	Scope:	04-01
Customer Sample:	HM-OP-ATV-03	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121001~~ 0412-EBRG-01 11/29/12 DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~T, 4-6~~ A/4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		**Comments:** 20% PART LOADING VERT TD
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed	
A5	B5	MD11	0		19.5	6.5						A
		MB		0	19	3	CD	CH		011322	/	B D
		MD11	1		18	7						A
		MB		1	16.3	1.5	CD	CH				BD
		MD11	2		9	3.5						A
		MB		2	9	1.7	CD	CH				B D
		MD22	3		19	12.5						A
		MB		3	11.5	1.2	CD	CH				B D
		MB		4	8.5	1	CD	CH				B D
												B D

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0038**	Volume (L):	695	Scope:	04-01
Customer Sample:	HM-OP-ATV-03	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121001~~ 0412-EBRG-01 11/29/12 DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~T, 4-6~~ A/4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		**Comments:** 20% PART LOADING VERT TD
GO Required:	11	none	3:1 / 5:1	
GO Analyzed:	11			
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM	Min Length:	> 5 micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25 micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed	
A5	C8	MD11	4		42	39.2						A
		MB		5	39.2	1.4	CD	CH		~~011322~~	11/29/12	B D
		F	5	6	5.5	.8	ADX	NRA	ACT NaK	011323	1	ABCD
	D10	B	6	7	10.6	3	CD	CH				ABCD
	D6	MD11	7		39.5	20						A
		MB		8	12.5	1.7	CD	CH				B D
		MD33	8		24	11.7			10			
		MB		9	22.6	3.5	CD	CH	11			B
		MB		10	7.6	1	CD	CH				B D
		MB ~~BRIDGE~~		11	6.5	.75	CD	CH				B D

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ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0038**	Volume (L):	695	Scope:	04-01
Customer Sample:	HM-OP-ATV-03	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121001~~ 0412-EBRG-01 11/29/12 DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~T, 4-6~~ A/4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/29/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:
20% PART LOADING
VERT TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed	
A5	F9	F	9	12	5	.6	ADX	NRA	ACT Nak			ABCD
	H7	MD21	10		13	3.5						A
		MB		13	13	2	CD	CH	0 13			B D
		MF		~~14~~ 0	4.5	1.3	ADX	ACT			1	B D
		MD11	11		9	4.5						A
		MB		14	9	1	CD	CH				B D
A6	B6	B	12	15	5.6	1	CD	CH				ABCD
		MD11	13		11	8						A
		MF		16	6.3	1	ADX	NRA	ACT Nak			B D

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0038**	Volume (L):	695	Scope:	04-01
Customer Sample:	HM-OP-ATV-03	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121001~~ 0412-EBRG-01 11/29/12	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~T, 4-6~~ A/4-6 DM	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:
20% PART LOADING
VERT TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed	
A6	B6	MD22	14		25	14			17			A
		MF		17	24.6	3.1	ADX	ACT	0	011327 0 ~~011328 M~~	FC 12/4/12	B
		MF		~~18~~ 0	8.5	1.4	NAM	NAM				
	D3	MD11	15		24	19						A
		MB		18	17	.5	CD	CH				B D
		MC11	16	19	19	18	CD	CH				
		MD11	17		21	~~21~~ 15	~~15~~					A
		MF		20	9.8	.6	ADX	ACT				B D
	G2	ND										
	H7	ND										

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0038**	Volume (L):	695	Scope:	04-01
Customer Sample:	HM-OP-ATV-03	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121001~~ 0412-EBRG-01 llbalb DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~T, 4-6~~ A/4-6	Analysis Date:	11/1/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ llbalb DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

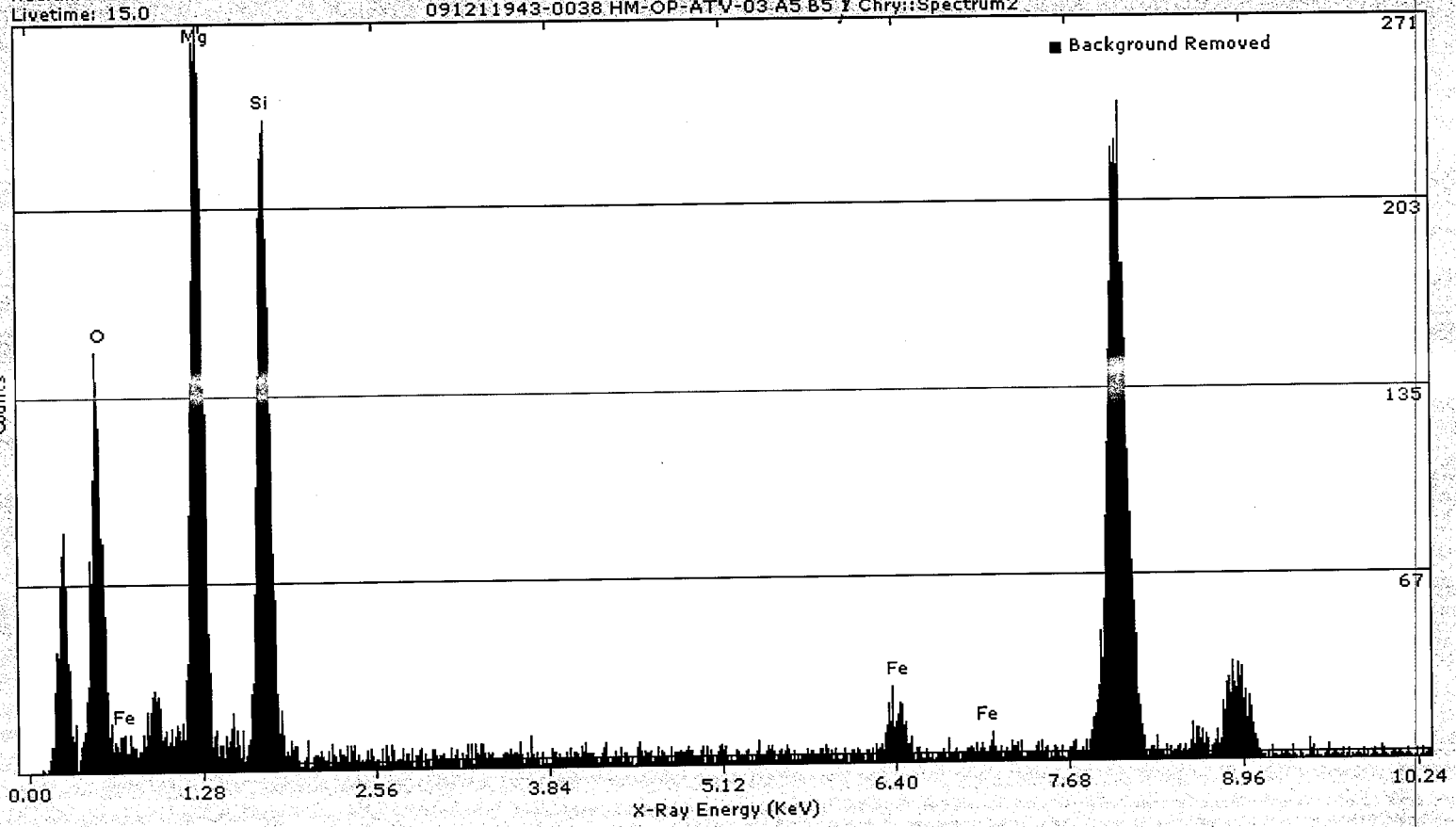
Comments:
20% PART LOADING
VERT TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed	
A6	I3	MD11	18		34.6	21						A
		MF		21	28.5	.7	ADX	ACT				B D
		MD11	19		55.2	18						A
		MB		22	52.2	3	CD	CH				B D
		MD11	20		~~>~~10	7						A
		MB		23	10	1	CD	CH				B D

Wed 11/14/11 pm

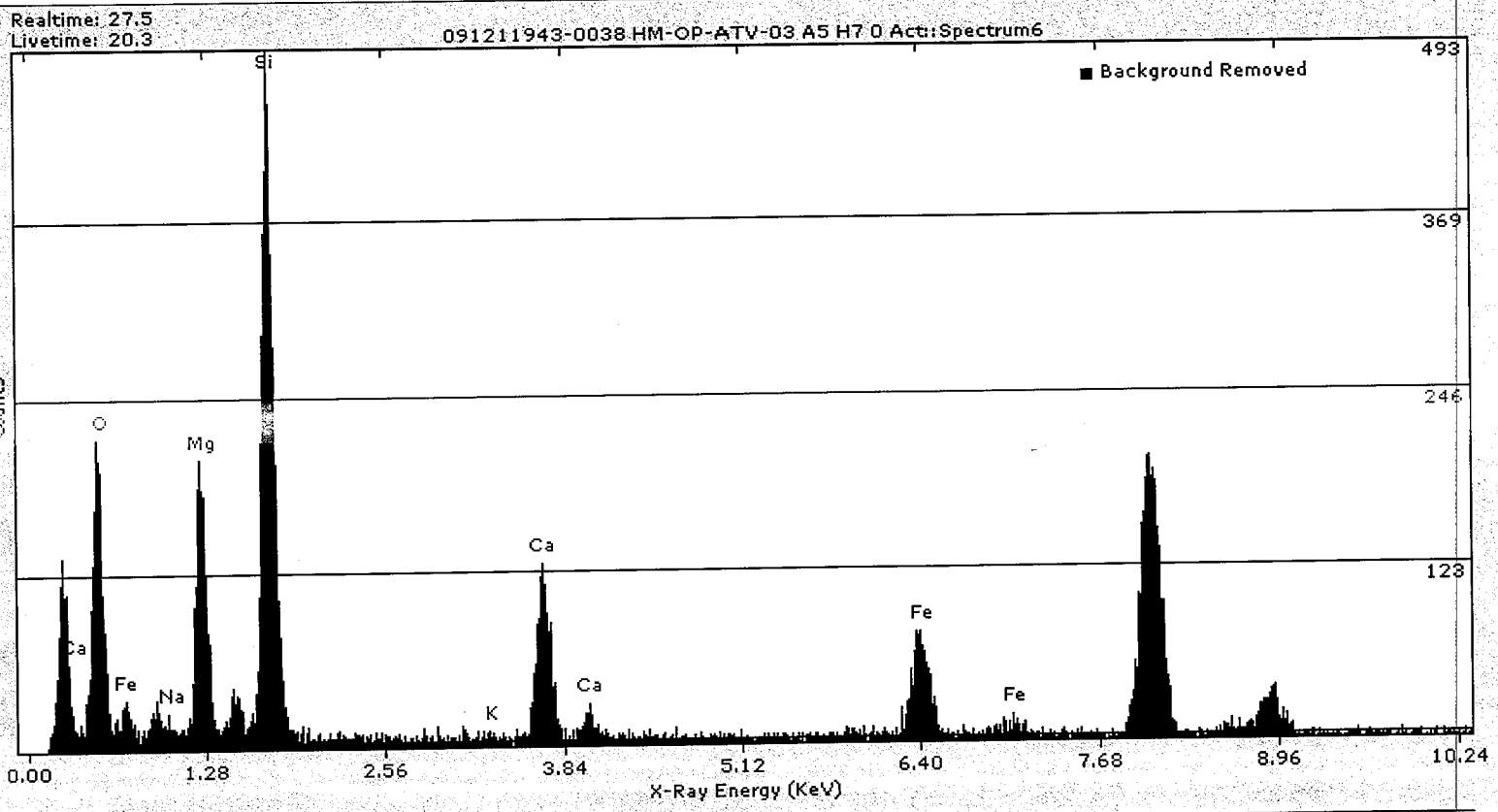
Realtime: 20.2
Livetime: 15.0

091211943-0038 HM-OP-ATV-03-A5 B5 1 Chry::Spectrum2



Quantitative Results for Spectrum2
Analysis: Thin Film Method: Standardless
Acquired 01-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	45.90	1.54	58.31	0.00		0.0000	0.0	85.8	1060.96
Magnesium	29.09	0.63	24.33	48.24	(MgO)	0.3939	2157.5	95.5	2122.82
Silicon	22.97	0.52	16.62	49.14	(SiO2)	0.2906	1986.2	101.4	1996.04
Iron	2.03	0.04	0.74	2.62	(FeO)	0.0155	145.3	146.1	198.17
Total	100.00			100.00					



Quantitative Results for Spectrum6
Analysis: Thin Film Method: Standardless
Acquired 01-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	44.94	0.76	60.62	0.00		0.0000	0.0	85.7	1473.57
Sodium	0.42	0.01	0.40	0.57	(Na2O)	0.0060	36.5	92.8	141.76
Magnesium	11.85	0.20	10.53	19.66	(MgO)	0.1805	1288.5	95.5	1439.76
Silicon	27.95	0.47	21.48	59.79	(SiO2)	0.3979	3542.2	101.4	3785.37
Potassium	0.16	0.00	0.09	0.19	(K2O)	0.0028	20.4	118.1	45.88
Calcium	8.03	0.13	4.32	11.23	(CaO)	0.0674	1058.0	122.1	1137.69
Iron	6.65	0.11	2.57	8.56	(FeO)	0.0486	696.7	146.1	866.00
Total	100.00			100.00					

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 01, 2012

Image Number: 011322

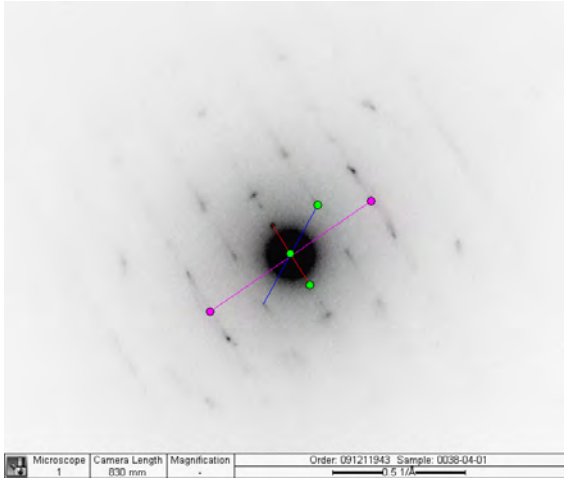
Reference / Sample Number: 0038

Preliminary ID: Chrysotile

Camera Constant: 2.9643032 **1/A Pixels**

Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.423**	5.3	**5.06**	**5.56**
Vector Angle:	**59.6**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.436**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.697**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

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AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Dec 04, 2012

Image Number: 091211943-0038-04-01_11323

Sample Number: 0038-04-01

Preliminary ID: Actinolite

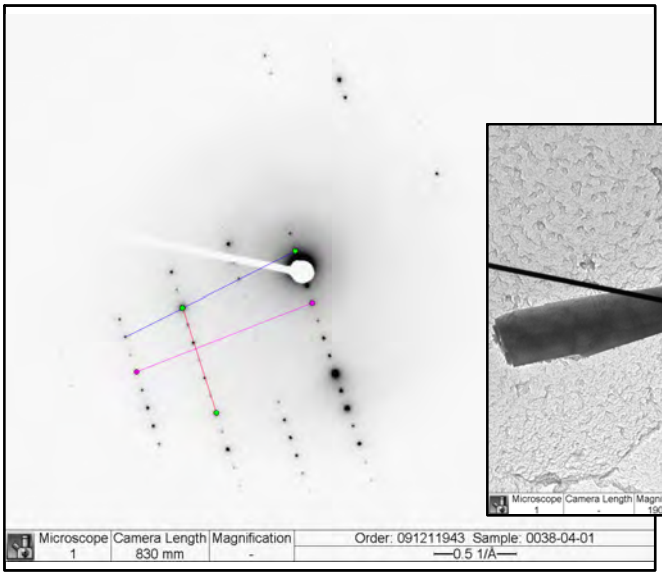
Camera Constant: 3.029e-003 **1/A Pixels**

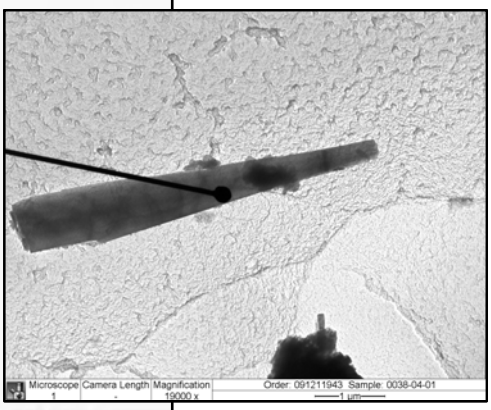
Calibration Reference: AuCal.112812_11459

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**2.636**	2.639	**2.507**	**2.771**
d2 or hk0 (Camera K/zero row dist.):	**9.027**	9.040	**8.588**	**9.492**
d1 or hkl (Camera K/slant vector dist.):	**2.609**	2.644	**2.512**	**2.776**
Ratio of hk0/hkl:	**3.460**	3.419	**3.248**	**3.590**
Vector Angle:	**80.8**	81.570	**77.491**	**85.648**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: [**2 0 1**]





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

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AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 01, 2012

Image Number: 011327

Sample Number: 0038-04-01

Preliminary ID: Actinolite

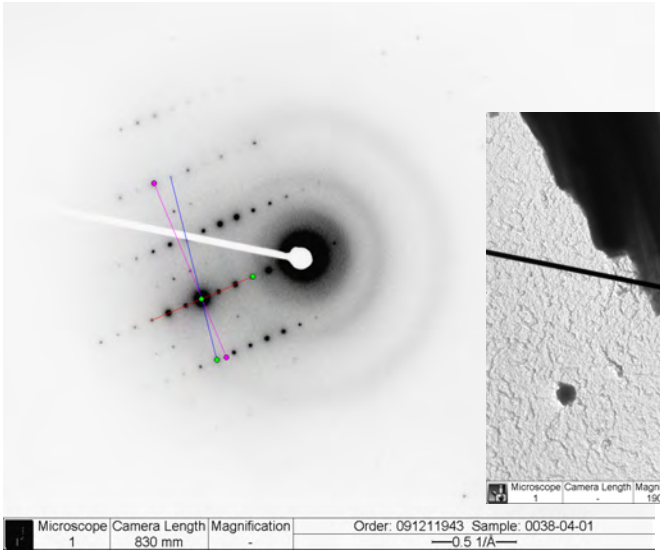
Camera Constant: 2.964e-003 **1/A Pixels**

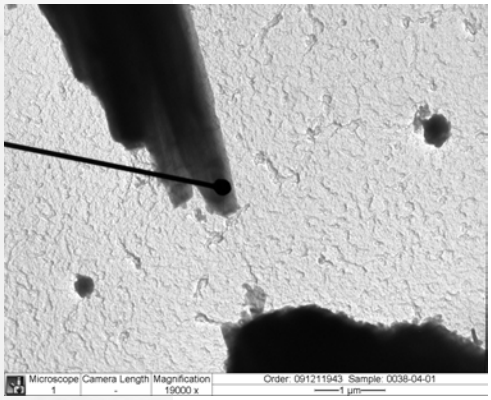
Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**2.684**	2.639	**2.507**	**2.771**
d2 or hk0 (Camera K/zero row dist.):	**4.582**	4.520	**4.294**	**4.746**
d1 or hkl (Camera K/slant vector dist.):	**2.680**	2.644	**2.512**	**2.776**
Ratio of hk0/hkl:	**1.710**	1.710	**1.624**	**1.796**
Vector Angle:	**81.1**	81.570	**77.491**	**85.648**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: **[2 0 1]**





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By:

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ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0039	Volume (L):	736	Scope:	09-02
Customer Sample:	HM-ATV-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	U, 3-5	Analysis Date:	10/4/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11	none	3:1	5:1
GO Analyzed:	0			
Level of Analysis Chrysotile:	CDQ 11/27/12 DM	Min Length:	>5 2 11/27/12 DM	micron
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron

Comments:

OVERLOADED
30%

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0039**	Volume (L):	736	Scope:	04-03
Customer Sample:	HM-ATV-04 11/29/12 DM	Prepped By:	PK	GO area (mm2):	~~0.0132~~ .0129 11/29/12 DM
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	PHenson
EFA (mm^2):	385	Grid Location:	U, 3-5	Analysis Date:	11/6/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		**Comments:**
GO Required:	11	none	3:1 5:1	
GO Analyzed:	11			
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM	Min Length: >5 ~~2~~ 11/29/12 DM	micron	
Level of Analysis Amphibole:	ADX	Min Width: 0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
U3	J~~X~~ 11/29	MD11	1		13.0	10.0					
		MB		1	13.0	0.8	CD	CH		03529	Y
		MB	2	2	9.0	2.0	CD	CH			
		MD11	3		11.5	6.0					
		MB		3	11.0	0.8	CD	CH			
	H3	MD11	4		30.0	7.0					
		MB		4	9.8	1.0	CD	CH			
		B	5	5	18.0	4.0	CD	CH			
	F5	B	6	6	8.0	1.5	CD	CH			
		B	7	7	7.0	1.5	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0039	Volume (L):	736	Scope:	04-03
Customer Sample:	op HM-ATV-04 11/28/12 DM	Prepped By:	PK	GO area (mm2):	~~0.0132~~ 0.0129 RD 11.15.12
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	PHenson
EFA (mm^2):	385	Grid Location:	U, 3-5	Analysis Date:	11/6/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		**Comments:**
GO Required:	11	none	3:1 5:1	
GO Analyzed:	11			
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DM	Min Length: >5 ~~2~~ 11/28/12 DM micron		
Level of Analysis Amphibole:	ADX	Min Width: 0.25 micron		

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
U3	C6	MD11	8		13.0	5.2					
↓	↓	MB		8	8.0	0.5	CD	CH			
↓	B8	NSD									
↓	A2	B	9	9	5.2	0.6	CD	CH			
↓	↓	B	10	10	11.2	0.4	CD	CH			
U4	A9	MD22	11		35.0	10.5					
↓	↓	MB		11	35.0	2.5	CD	CH	11 12		
↓	↓	MF	PK 11/28/12	~~12~~ 0	18.8	1.0	~~ADX~~ NRA PK 11/28/12	NRA		03530	Y
↓	↓	F	~~12~~ 0	~~13~~ 0	5.4	0.7	NRA	NRA			
↓	↓	F	~~13~~ 0	~~14~~ 0	22.0	1.2	NRA	NRA			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0039**	Volume (L):	736	Scope:	04-03
Customer Sample:	HM-ATV-04 (OPV 11/29/12 DM)	Prepped By:	PK	GO area (mm2):	~~.0132~~ .0129 (11/29/12 DM)
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	PHenson
EFA (mm^2):	385	Grid Location:	U, 3-5	Analysis Date:	11/6/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		**Comments:**
GO Required:	11	none	3:1 5:1	
GO Analyzed:	11			
Level of Analysis Chrysotile:	CD~~Ø~~ (11/29/12 DM)	Min Length:	>5 ~~2~~ (11/29/12 DM) micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25 micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
U4	C5	B	24 (11/29/12) ~~1~~ 0	0	17.0	1.8	NRA	NRA			
↓	E10	B	12	12	13.4	0.5	CD	CH			
	↓	B	13	13	12.7	0.7	CD	CH			
	G6	NSD									
	I8	↓									

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

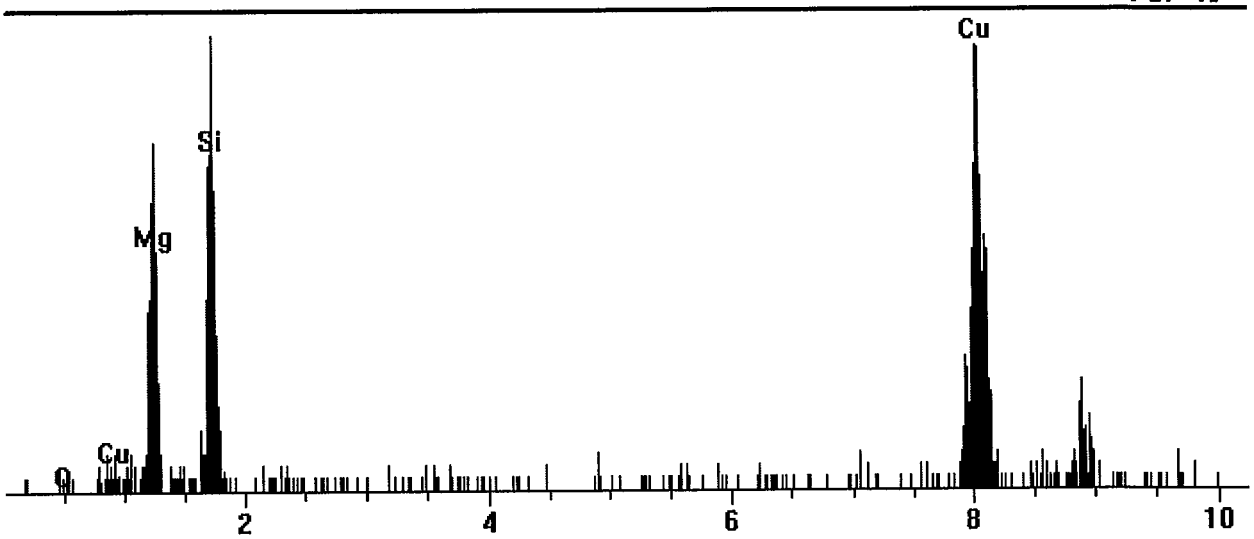
EMSL ANALYTICAL, INC.

File: L:\EDS Spe...Spectra\Scope 04-03\2012\091211943-0039 U3 J8 1 CH.pgt
Collected: Nov 6, 2012 11:26:56

Live Time:	8.48	Count Rate:	323	Dead Time:	6.71 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	54078.24				

091211943-0039 U3 J8 1 CH.pgt

FS: 40



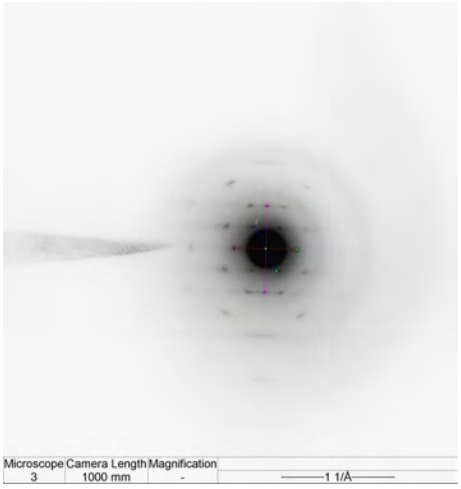
Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.7800	35.18	30.24	43.5	MgO	58.32
Si	KA1	1.740	1.0000	26.55	19.76	28.5	SiO	41.68
Cu	KA1	8.046	0.0000	0.00	0.00	0.0		
O	KA1	0.523	0.0000	38.27	50.00	72.0		
Total			**0.0000**	**100.00**	**100.00**	**144.0**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	39.2	2.1	37.1
Si	KA1	52.1	2.2	49.8
Cu	KA1	95.7	0.0	95.7
O	KA1	0.6	1.1	0.0

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number:	091211943	**Date:**	Nov 06, 2012
Image Number:	03529		
Reference / Sample Number:	0039		
Preliminary ID:	Chrysotile		
Camera Constant:	1.9639471	**1/A Pixels**	
Calibration Reference:	110512-04-03-03523_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.247**	5.3	**5.06**	**5.56**
Vector Angle:	**62.6**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.195**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.554**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	0912111943-0040	Volume (L):	694	Scope:	09-02
Customer Sample:	HM-OP-ATV-05	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	A, 1-3	Analysis Date:	10/4/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			
GO Required:	11	none	3:1	5:1	
GO Analyzed:	0				
Level of Analysis Chrysotile:	CDØ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Comments:

OVERLOADED
28%

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0040 11/28/12 DM	Volume (L):	694	Scope:	04-01
Customer Sample:	HM-OP-ATV-05	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121002~~ 0412-BRRG-01 11/28/12 DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~A, 1-3~~ F/5-8	Analysis Date:	11/9/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥ 0.25	micron

Comments:
25% PART. LOADING
VERTICAL TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F5	I3	B	1	1	6	1	CD	CH			1
		MD11	2		8.2	6					
		MB		2	8.2	1	CD	CH		011412	
	G5	MC22	3	3	22.5	13	CD	CH			
		MD11	4		5.2	3					
		MB		4	5.2	1.1	CD	CH			
		MC11	5	5	9	8	CD	CH			
		F	6	6	5.8	.75	CD	CH		011413	
	F2	MC11	7	7	29	7	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0040 11/29/12 DM	Volume (L):	694	Scope:	04-01
Customer Sample:	HM-OP-ATV-05	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121002~~ 0412-ERRG-01	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~A, 1-3~~ F/5-8 11/29/12 DM	Analysis Date:	11/9/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:** 25% PART. LOADING VERTICAL TD
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/29/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	≥ 0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F5	F2	MD11	8		10	2.2					
		MB		8	10	1.2	CD	CH			
	D1	MD11	0		5.8	2					
		MF		0	5.8	.4	ADX	NRA			1
	C7	MC11	9	9	39	19	CD	CH			
		MD11	10		9	3.5					
		MB		10	9	.5	CD	CH			
	B4	MC11	11	11	16.5	13.5	CD	CH			
		MD11	12		78	22					
		MB		12	78	14	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0040 11/29/12 DM	Volume (L):	694	Scope:	04-01
Customer Sample:	HM-OP-ATV-05	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121002~~ 0412-BRRG-01	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~A, 1-3~~ F/5-8 11/29/12 DM	Analysis Date:	11/9/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥ 0.25	micron

Comments:
25% PART. LOADING
VERTICAL TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
F5	B4	MD11	13		26.3	10.8					
		MB		13	13.5	3.2	CD	CH			
F6	B2	MD11	14		28.5	21					
		MB		14	13	2.2	CD	CH			
	D5	MD22	15		31	28					
		MB		15	27	2	CD	CH			
		MB		16	18.5	6	CD	CH			
	E3	ND									
	F1	ND									

ISO 10312

TEM Asbestos Count Sheet

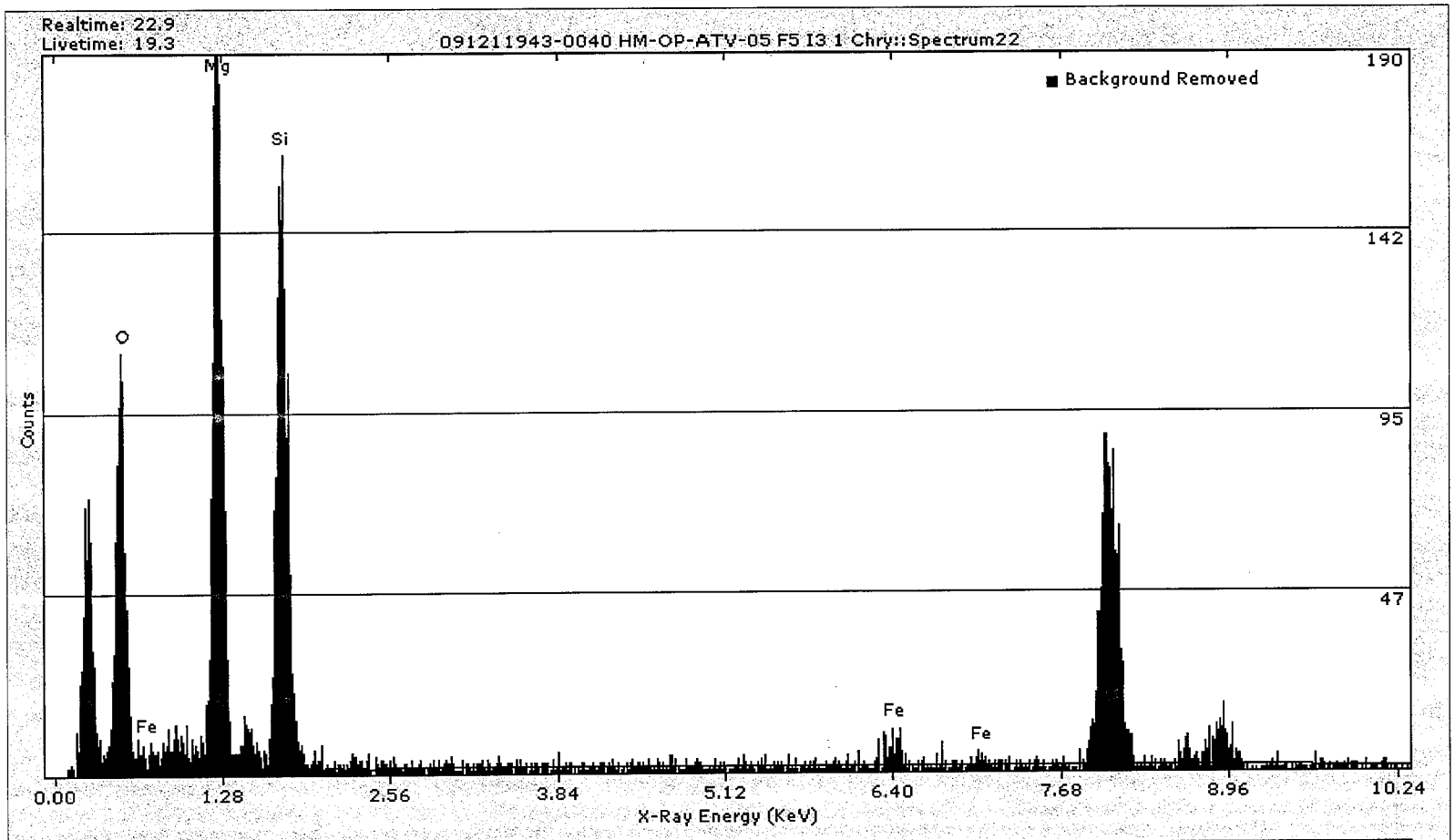
EMSL Sample ID:	11/29/12 DM 0912111943-0040	Volume (L):	694	Scope:	04-01
Customer Sample:	HM-OP-ATV-05	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121002~~ 0412-ERRG-01 11/29/12 DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~A, 1-3~~ F/5-8	Analysis Date:	11/9/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/29/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥ 0.25	micron

Comments: 25% PART. LOADING VERTICAL TD

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F6	H4	MD11	16		6.5	1.7					
		MB		17	6.5	1	CO	CH			
		MD11	17		8	3.5					
		MB		18	6.2	.25	CO	CH			



Quantitative Results for Spectrum22
Analysis: Thin Film Method: Standardless
Acquired 10-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.43	1.27	58.35	0.00		0.0000	0.0	85.8	754.13
Magnesium	30.13	0.82	24.92	49.97	(MgO)	0.3878	1342.5	95.5	1452.39
Silicon	23.32	0.64	16.69	49.88	(SiO2)	0.2814	1214.1	101.4	1270.10
Iron	0.12	0.00	0.04	0.15	(FeO)	0.0077	5.0	146.2	78.79
Total	100.00			100.00					

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 10, 2012

Image Number: 011412

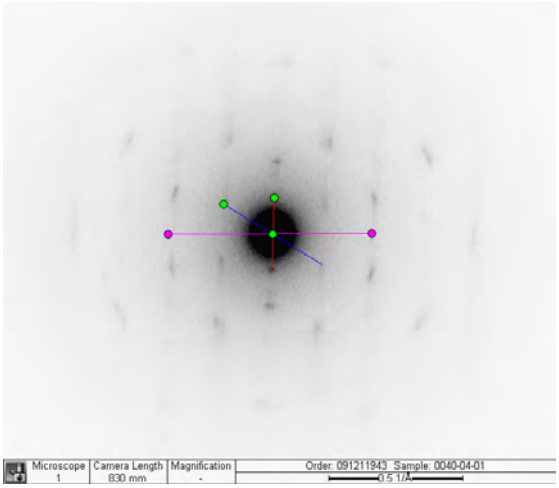
Reference / Sample Number: 0040

Preliminary ID: Chrysotile

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.272**	5.3	**5.06**	**5.56**
Vector Angle:	**60.4**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.360**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.658**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 10, 2012

Image Number: 011413

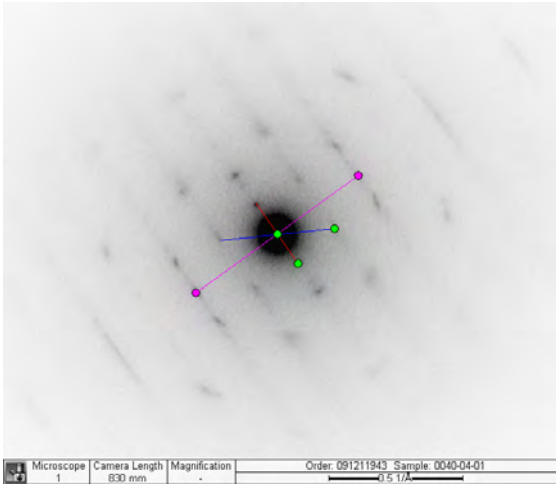
Reference / Sample Number: 0040

Preliminary ID: Chrysotile

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.359**	5.3	**5.06**	**5.56**
Vector Angle:	**61.1**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.312**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.680**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0041**	Volume (L):	733	Scope:	09-02
Customer Sample:	HM-OP-MB-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	A, 4-6	Analysis Date:	10/4/2012

Analysis Information

Target Sensitivity: 0.004 s/cc

GO Required: 11

GO Analyzed: 0

Level of Analysis Chrysotile: CD~~Q~~ 11/27/12 DM

Level of Analysis Amphibole: ADX

Minimum Aspect Ratio: (circle one)

none | 3:1 | 5:1

Min Length: >5 ~~0.5~~ 11/27/12 DM micron

Min Width: 0.25 ~~NONE~~ micron

Comments:

OVERLOADED

25%

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0041	Volume (L):	733	Scope:	04 01
Customer Sample:	HM-OP-MB-01	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121002~~ 0412-ERRG-01 11/29/12 DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~A, 4-6~~ B/1-3	Analysis Date:	11/2/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one) none [3:1] 5:1		**Comments:** 10% - 15% PART. LOADING VERTICAL TD
GO Required:	11			
GO Analyzed:	11			
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DM	Min Length: >5 ~~0.5~~ 11/28/12 DM micron		
Level of Analysis Amphibole:	ADX	Min Width: 0.25 ~~NONE~~ micron		

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
B1	I2	MD10	0~~1~~ 11/29/12 DM		4.5	2.1					
		MF		0~~1~~	4	.25	CD	CH			1
		MD32	1 ~~2~~ 11/29/12 DM		18	12.8					
		MB		1~~2~~	11	.5	CM	CH			
		MF	11/29/12 DM	2~~3~~	6.6	1.5	ADX	ACT	4 2 3	011331	1
		MR10		0~~4~~	2.6	.06	CM	CH			
	E7	ND									
	G1	↓									
	E3										
	~~C6~~										

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0041**	Volume (L):	733	Scope:	04-01
Customer Sample:	HM-OP-MB-01	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121002~~ 0412-ERRG-01 11/29/12 DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~A, 4-6~~ B/1-3	Analysis Date:	11/2/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM		Min Length: >5 ~~0.5~~ 11/29/12 DM		micron
Level of Analysis Amphibole:	ADX		Min Width: 0.25 ~~NONE~~		micron

Comments:
10% - 15% PART. LOADING
VERTICAL TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
B1	C6	MD22	~~3~~2 11/29/12 DM		21	16			6		
		MB		3~~8~~	9.2	1.6	CD	CH	W/AM	011333	
		MF		4~~6~~	7.5	.7	ADX	ACT	5		
	B4	MD11	~~1~~3 11/29/12 DM		15.6	2.2					
		MB		5~~7~~	15.6	1.7	CD	CH			
B2	I9	~~MC10~~ NO	~~5~~	~~8~~	~~4.5~~	~~4.2~~	~~CD~~ 11/29/12 DM	~~CH~~			
	F6	B	~~6~~4	6~~9~~	5.7	.3	CD	CH			
	E9	MD11	~~7~~5 11/29/12 DM		11	4.5					
		MB		7~~10~~	11	4.5	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0041**	Volume (L):	733	Scope:	04 01
Customer Sample:	HM-OP-MB-01	Prepped By:	PK	GO area (mm2):	.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121002~~ 0412-ERRG-01 11/29/12 DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~A, 4-6~~ B/1-3	Analysis Date:	11/2/12

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)	
GO Required:	11		none	3:1	5:1
GO Analyzed:	11			
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM		Min Length: >5 ~~0.5~~ 11/29/12 DM	micron
Level of Analysis Amphibole:	ADX		Min Width: 0.25 ~~NONE~~	micron

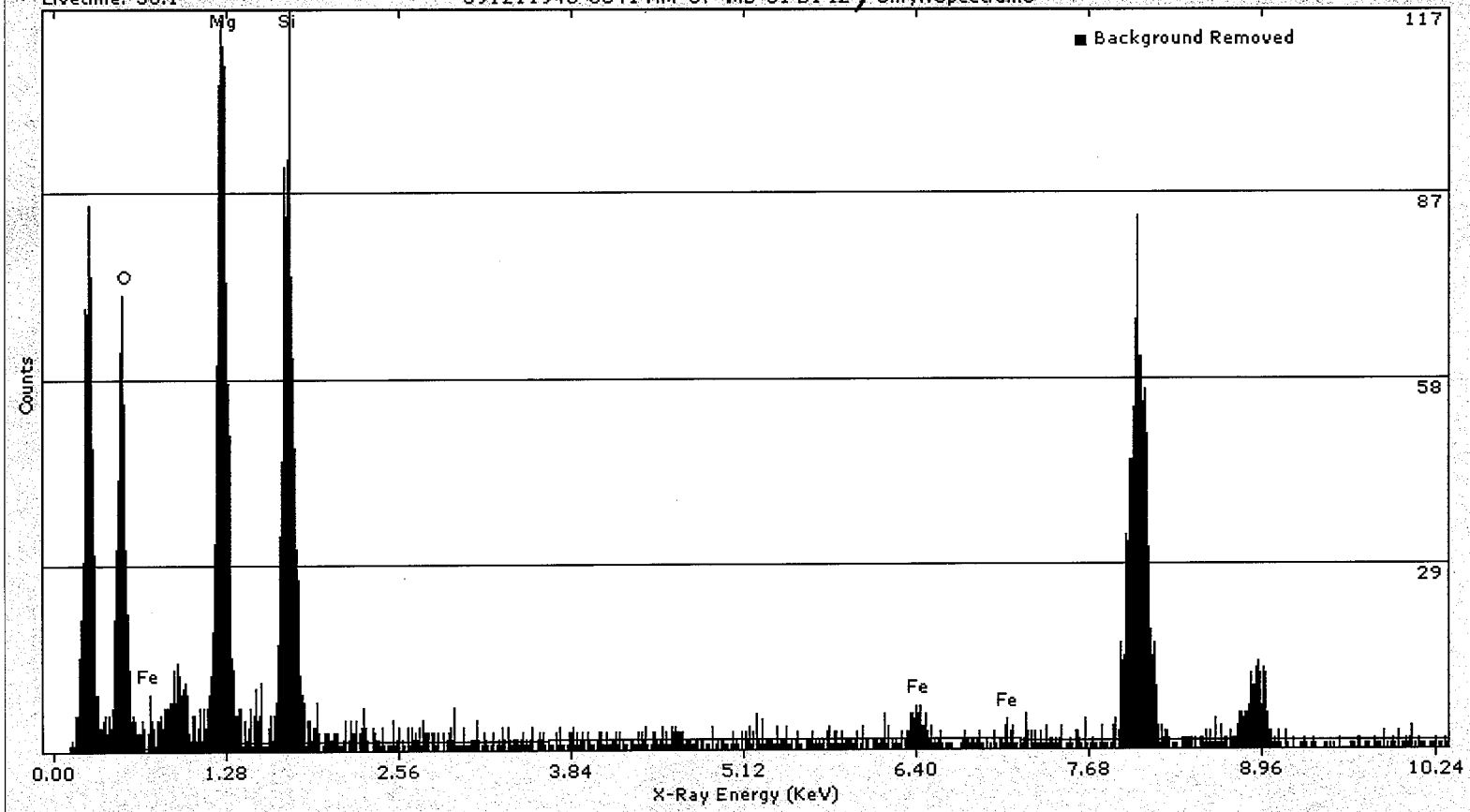
Comments:
10% - 15% PART. LOADING
VERTICAL TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
B2	E9	MD22	~~8~~ 6	11/29/12 DM	51	18.5			11		
		MB		~~11~~ 8	~~Ø~~ 51	4	CD	CH	12		
		MR11	11/29/12 DM	~~12~~ 9	6.5	.25	CD	CH	8		
	D3	MD11	~~9~~ 7		15	1.6					
		MB	11/29/12 DM	10 ~~13~~	15	1	CD	CH			
	B8	MCTO	~~10~~ 8	11 ~~14~~	8.5	6.2	CD	CH			

0 11/29/10 DM

Realtime: 41.1
Livetime: 38.1

091211943-0041 HM-OP-MB-01 B1 I2 / Chry::Spectrum3



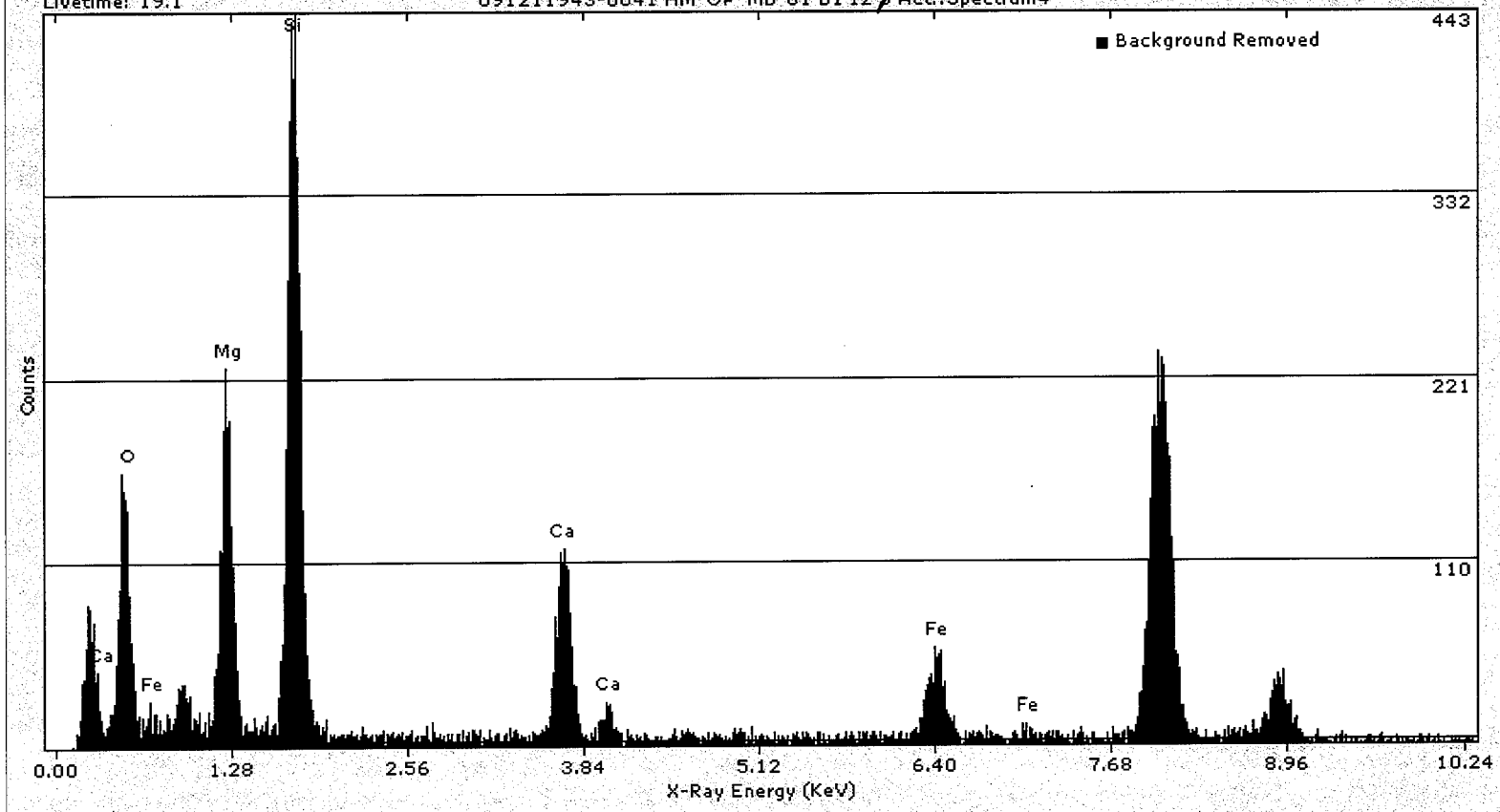
Quantitative Results for Spectrum3
Analysis: Thin Film Method: Standardless
Acquired 02-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.53	1.71	58.64	0.00		0.0000	0.0	85.8	440.42
Magnesium	28.75	1.06	23.85	47.67	(MgO)	0.3802	742.2	95.6	817.10
Silicon	24.07	0.89	17.28	51.49	(SiO2)	0.2965	726.3	101.4	793.14
Iron	0.65	0.02	0.24	0.84	(FeO)	0.0084	16.2	146.2	40.00
Total	100.00			100.00					

11/29/12 DM

Realtime: 26.1
Livetime: 19.1

091211943-0041 HM-OP-MB-01 B1 I2 Z Act::Spectrum4



Quantitative Results for Spectrum4
Analysis: Thin Film Method: Standardless
Acquired 02-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	45.52	0.75	60.57	0.00		0.0000	0.0	85.8	1182.90
Magnesium	14.01	0.23	12.27	23.23	(MgO)	0.2296	1576.2	95.5	1578.69
Silicon	27.88	0.46	21.13	59.64	(SiO2)	0.4288	3657.1	101.4	3742.68
Calcium	8.24	0.14	4.37	11.53	(CaO)	0.0752	1124.2	122.2	1160.72
Iron	4.35	0.07	1.66	5.60	(FeO)	0.0340	471.8	146.2	585.62
Total	100.00			100.00					

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 02, 2012

Image Number: 011331

Sample Number: 0041-04-01

Preliminary ID: Actinolite

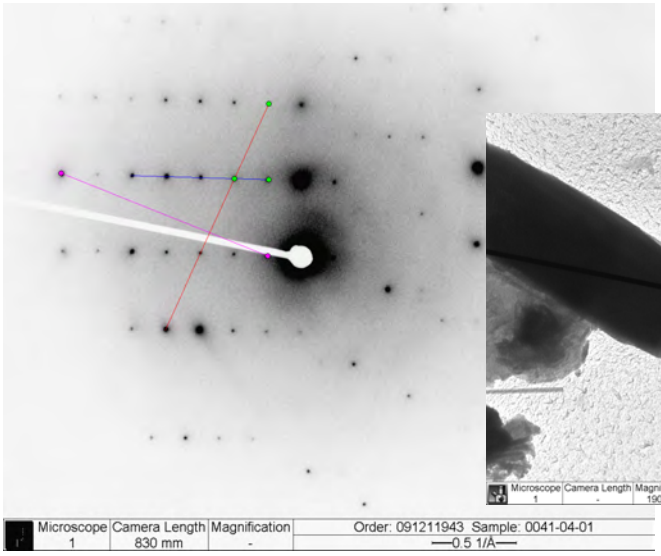
Camera Constant: 2.964e-003 **1/A Pixels**

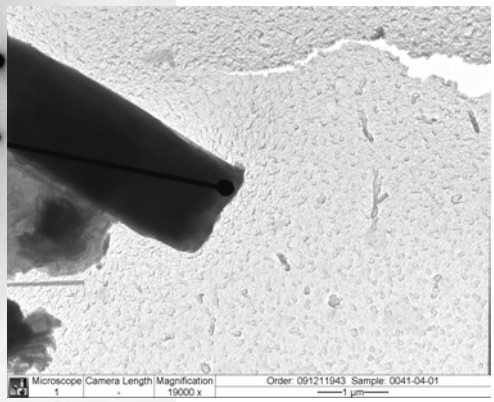
Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.294**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**2.036**	2.001	**1.901**	**2.101**
d1 or hkl (Camera K/slant vector dist.):	**4.905**	4.882	**4.638**	**5.126**
Ratio of hk0/hkl:	**0.415**	0.410	**0.389**	**0.430**
Vector Angle:	**67.6**	67.650	**64.267**	**71.033**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: **[7 3 4]**





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 02, 2012

Image Number: 011333

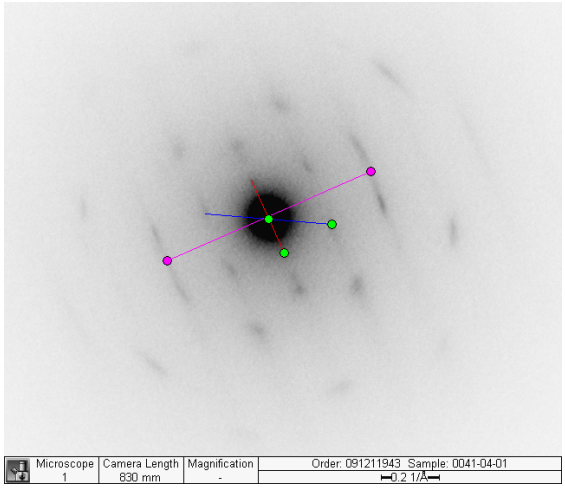
Reference / Sample Number: 0041

Preliminary ID: Chrysotile

Camera Constant: 2.964e-003 **1/A Pixels**

Calibration Reference: 102312.AuCal_11282

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.259**	5.3	**5.06**	**5.56**
Vector Angle:	**61.0**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.318**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.606**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0042**	Volume (L):	696	Scope:	09-02
Customer Sample:	HM-OP-MB-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	B, 1-3	Analysis Date:	10/4/2012

Analysis Information

Target Sensitivity: 0.004 s/cc
GO Required: 11
GO Analyzed: 11
Level of Analysis Chrysotile: CDQ 11/27/12 am
Level of Analysis Amphibole: ADX

Minimum Aspect Ratio: (circle one)
none 3:1 5:1

Min Length: > 5 micron
Min Width: 0.25 micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B1	F1	B	1	1	5.05	0.3	CD	CHRYS		44023 ~~43937~~ mm 12/5/12	
B1	F1	B	2	2	7.4	1.4	CD	CHRYS			
B1	F1	B	3	3	5.8	0.45	CD	CHRYS			
B1	F1	B	4	4	29.5	9.6	CD	CHRYS			
B1	F3	B	5	5	10.8	0.55	CDQ	CHRYS			YES
B1	F5	ND									
B1	F7	ND									
B2	B1	B	6	6	5.55	0.3	CD	CHRYS			
B2	B3	B	7	7	5.5	1.05	ADX	ACTINOLITE		44004	YES
B2	B3	B	8	8	9.85	1.15	CD	CHRYS			

ISO 10312

091211943-0042

TEM Asbestos Count Sheet

B2	B3	B	9	9	8.9	0.55	ADX	ACTINOLITE			
B2	B3	B	10	10	6.6	1	CD	CHRYS			
B2	B5	B	11	11	16.15	2.5	CD	CHRYS			
B2	B5	B	12	12	20.5	0.98	CD	CHRYS			
B2	B5	B	13	13	16.6	2.2	CD	CHRYS			
B2	B8	B	14	14	11.25	1.05	CD	CHRYS			
B3	E10	B	15	15	7.2	1.15	CD	CHRYS			
B3	E8	B	16	16	9.75	1.6	CD	CHRYS			
B3	E6	MD11	17		12	2	ADX	ACTINOLITE			
B3	E6	MF		17	10	0.5	ADX	ACTINOLITE			

ND= None Detected

NAM= Non Asbestos Material

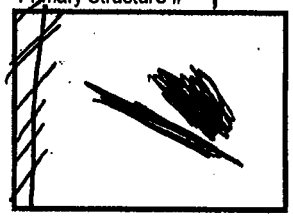
TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 0912119413-0012 **Client:**

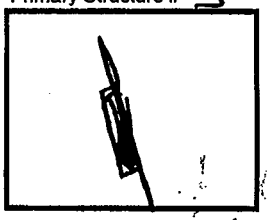
Client Sample: Page 1 of 1

Primary Structure # 1

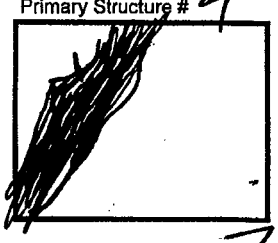


Primary Structure # 2

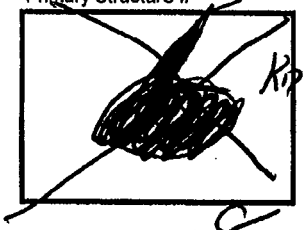
Primary Structure # 3



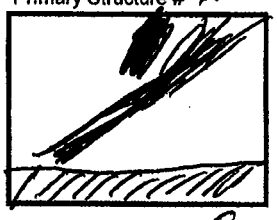
Primary Structure # 4



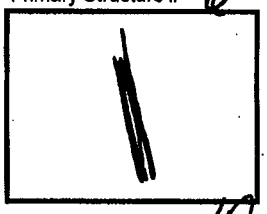
Primary Structure # 5



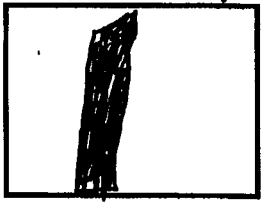
Primary Structure # 5



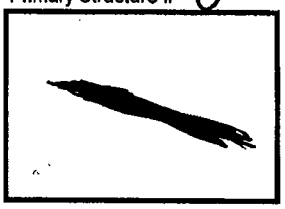
Primary Structure # 6



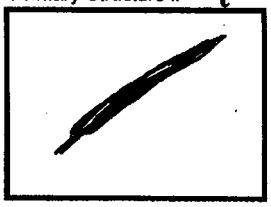
Primary Structure # 7



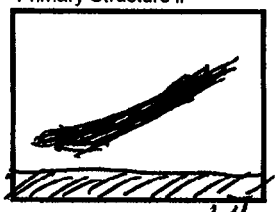
Primary Structure # 8



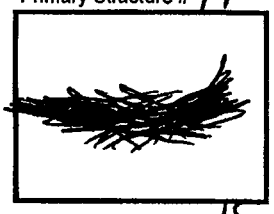
Primary Structure # 9



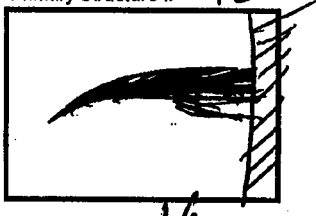
Primary Structure # 10



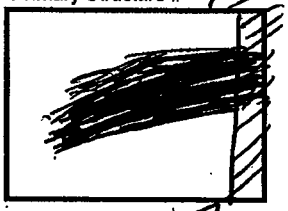
Primary Structure # 11



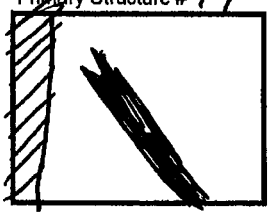
Primary Structure # 12



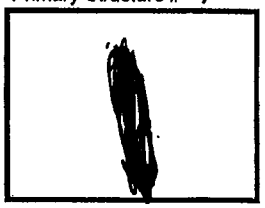
Primary Structure # 13



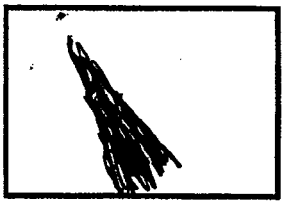
Primary Structure # 14



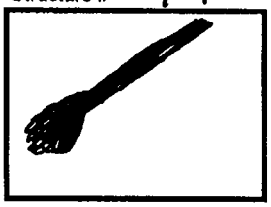
Primary Structure # 15



Structure # 16



Structure # 17



Structure #

Structure #

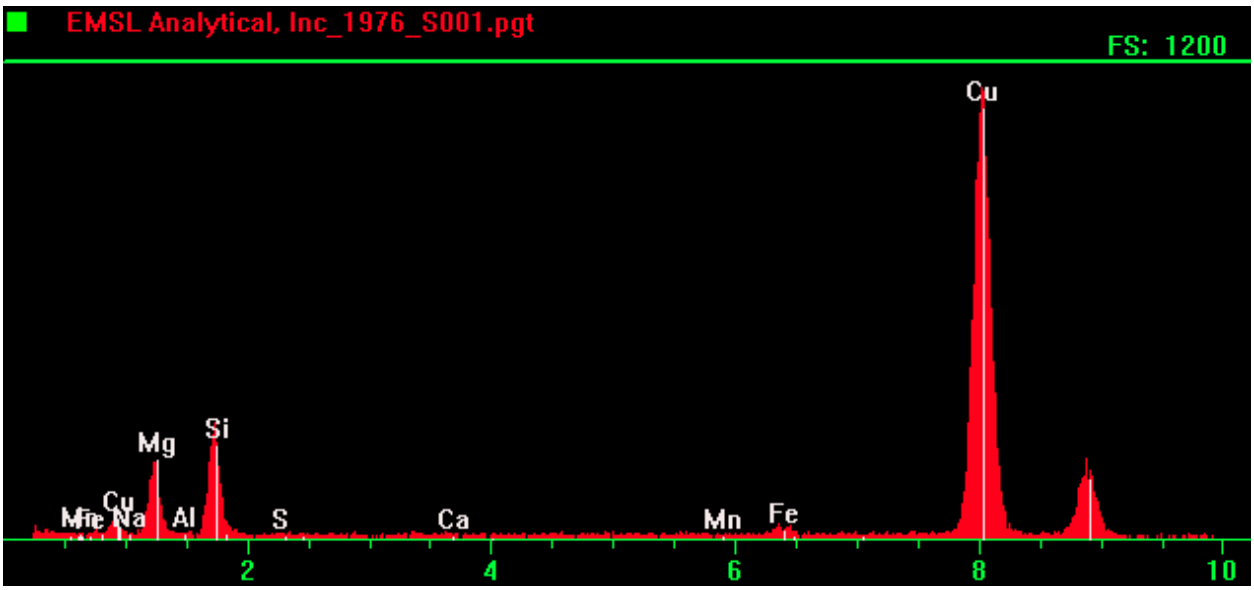
Analyst: KD Date: 7/02/12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0042_TEM_ISO_10312_EDX_Chrysotile
Collected: October 07, 2012 10:07:11

Live Time:	46.13	Count Rate:	1625	Dead Time:	20.26 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



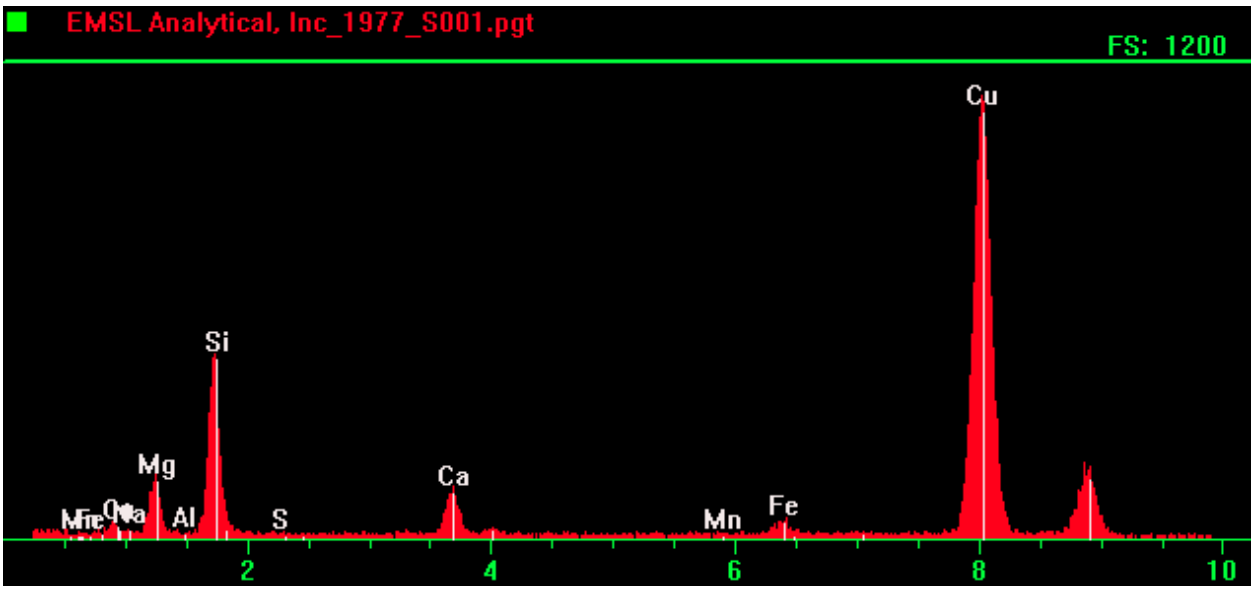
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	6.4	5.5	0.0	0.0
Mg	KA1	80.8	5.7	75.1	13.1
Al	KA1	7.1	6.0	1.1	0.2
Si	KA1	110.5	5.7	104.8	18.5
S	KA1	6.2	4.7	1.6	0.3
Ca	KA1	5.8	5.3	0.5	0.1
Mn	KA1	6.9	6.8	0.0	0.0
Fe	KA1	18.9	7.2	11.6	1.6
Cu	KA1	699.3	9.3	690.0	74.2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0042_TEM_ISO_10312_EDX_Actinolite
Collected: October 07, 2012 10:21:11

Live Time:	47.81	Count Rate:	1756	Dead Time:	21.24 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	7.9	6.7	0.2	0.0
Mg	KA1	56.9	7.5	49.4	6.6
Al	KA1	7.4	7.8	0.0	0.0
Si	KA1	177.1	7.6	169.6	22.4
S	KA1	6.0	6.2	0.0	0.0
Ca	KA1	58.8	6.9	51.9	7.5
Mn	KA1	7.8	7.4	0.4	0.1
Fe	KA1	28.7	8.6	20.1	2.4
Cu	KA1	671.5	10.4	661.1	63.6

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: ~~43937~~ 44023 12/5/12 OM SCOPE #: 2

Reference / Sample Number: 42

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.52 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.29**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

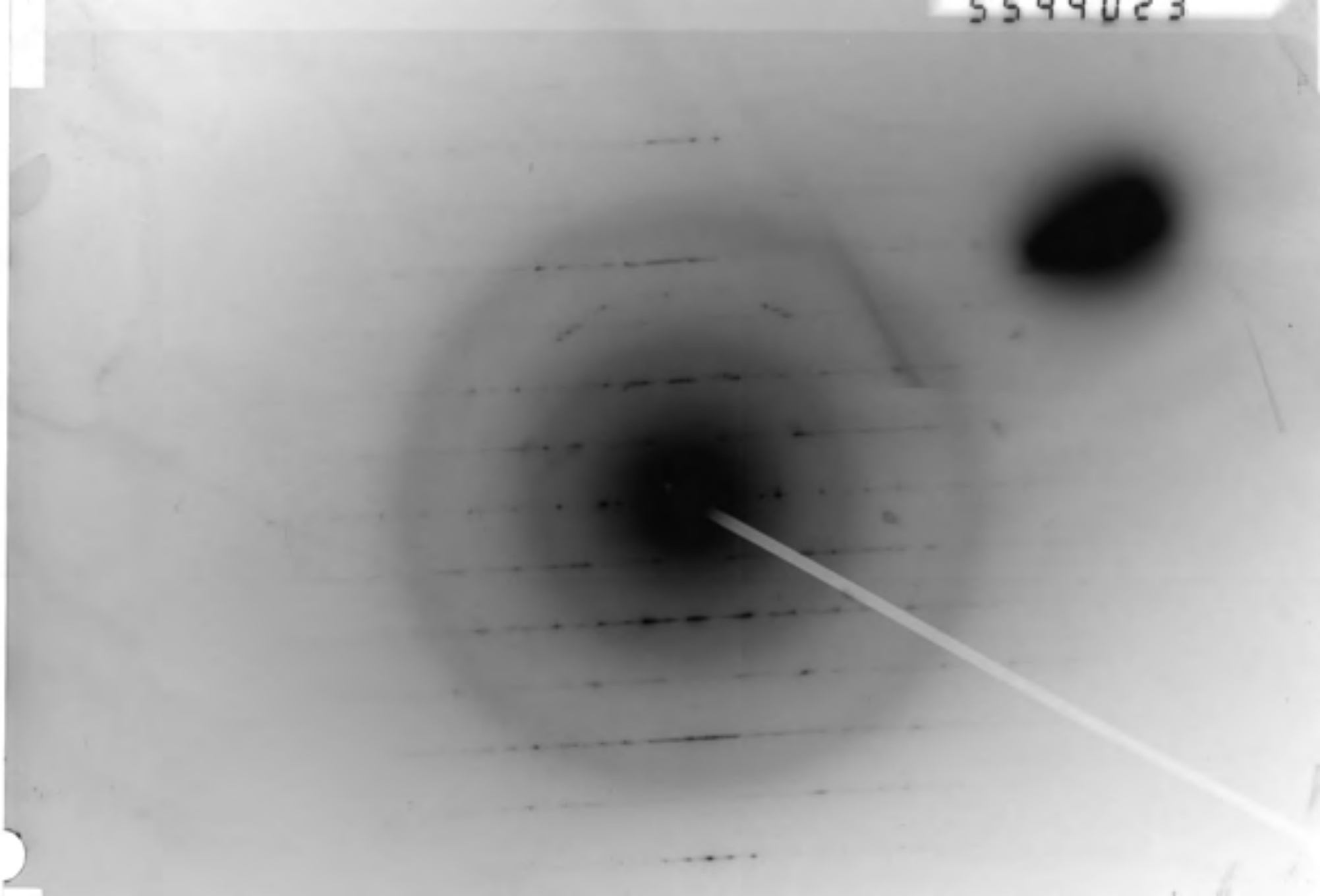
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

5594023



EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 44004 SCOPE # 2

Reference / Sample Number: 42

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.6 mm
Mean Distance between spots on Center row (d2): 2.65 mm
Mean distance between spots on slant vector (d1): 4.75 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.19**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**9.02**	9.055	**8.602**	**9.508**
d1 or hk1 (Camera K/slant vector dist.)	**5.03**	5.158	**4.900**	**5.416**
Ratio of hk0/hk1	**1.79**	1.76	**1.672**	**1.848**
Angle of Slant Vector (Measured)	89.0	90.0	**85.500**	**94.500**

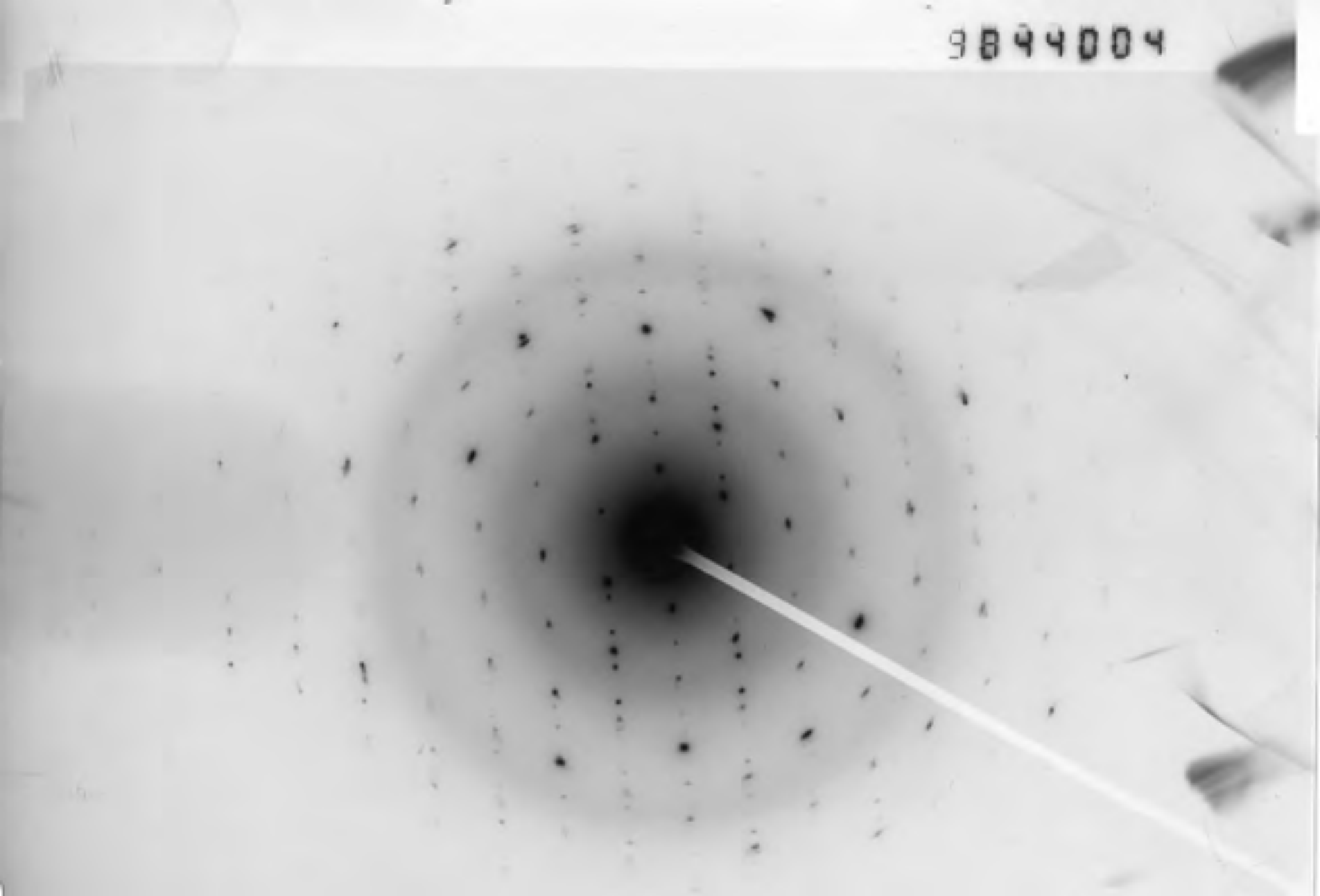
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [1 0 0]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9844004



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0043	Volume (L):	~~768~~ 726 11/27/12 DM	Scope:	09-02
Customer Sample:	HM-OP-MB-0~~4~~3 11/27/12 DM	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	B, 4-6	Analysis Date:	10/7/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B4	C1	B	1	1	7.2	2.2	CD	CHRYS		44008	
B4	C3	B	2	2	7.2	0.35	CD	CHRYS			
B4	C3	B	3	3	8.3	2.3	CD	CHRYS			
B4	C3	B	4	4	7.6	0.95	CD	CHRYS			
B4	C3	B	5	5	14.8	2.6	CD	CHRYS			
B4	C3	B	6	6	7.4	2.3	CD	CHRYS			
B4	C3	B	7	7	8.15	0.8	CD	CHRYS			
B4	C5	B	8	8	11.6	1.6	CD	CHRYS			
B4	C5	B	9	9	21.2	3.8	CD	CHRYS			YES
B4	C5	B	10	10	48.3	15	CD	CHRYS			

ISO 10312

TEM Asbestos Count Sheet

B4	C7	B	11	11	7.3	1.3	CD	CHRYS			
B4	C7	B	12	12	13.8	1.3	CD	CHRYS			
B4	C7	CC	13	13	8.9	2.5	CD	CHRYS			
B4	C7	B	14	14	11.1	3.6	CD	CHRYS			
B4	C7	MD11	15		12.8	5.8	CD	CHRYS			
B4	C7	MB		15	7.9	1.5	CD	CHRYS			
B5	F1	B	16	16	16.95	2.2	CD	CHRYS			
B5	F1	B	17	17	12.2	3.5	CD	CHRYS			
B5	F1	B	18	18	7.3	1.3	CD	CHRYS			
B5	F1	B	19	19	11.8	1.8	CD	CHRYS			
B5	F3	ND									
B5	F5	B	20	20	5.55	1.1	CD	CHRYS			
B5	F5	MD11	21		10.3	2.1	ADX	ACTINOLITE		44007	YES
B5	F5	MF		21	10.3	0.6	ADX	ACTINOLITE			
B5	F5	B	22	22	6.8	1.6	CD	CHRYS			
B5	F5	B	23	23	10.4	2.1	CD	CHRYS			
B5	F5	B	24	24	5.6	1.2	CD	CHRYS			
B5	F5	B	25	25	5.4	0.35	CD	CHRYS			
B5	F5	B	26	26	6.5	1	CD	CHRYS			
B5	F5	B	27	27	102.4	11.2	CD	CHRYS			
B5	F7	B	28	28	10.9	1.8	CD	CHRYS			
B5	F7	B	29	29	11.1	1.4	CD	CHRYS			
B6	J6	B	30	30	20.4	1	CD	CHRYS			
B6	J6	B	31	31	6.6	1.9	CD	CHRYS			
B6	J6	B	32	32	11.2	2.8	CD	CHRYS			
B6	J4	B	33	33	24.5	2.6	CD	CHRYS			
B6	J4	B	34	34	19.4	4	CD	CHRYS			
B6	J4	B	35	35	52.1	6.8	CD	CHRYS			
B6	J4	B	36	36	17.8	3.9	CD	CHRYS			
B6	J2	B	37	37	10.6	2.2	CD	CHRYS			
B6	J2	MD11	38		31	21	CD	CHRYS			
B6	J2	MB		38	10	0.5	CD	CHRYS			
B6	J2	B	39	39	41.8	0.5	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

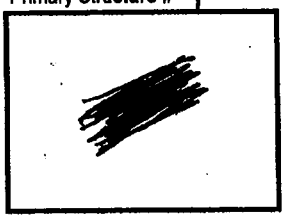
TEM ISO 10312

Structure Sketch Sheet

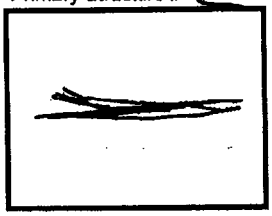
EMSL Order ID: 0912119943-43 **Client:**

Client Sample: Page 1 of 2

Primary Structure # 1



Primary Structure # 2



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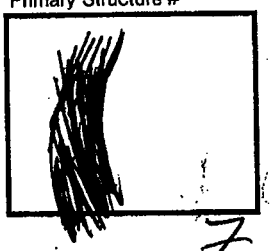

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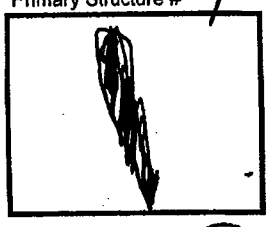
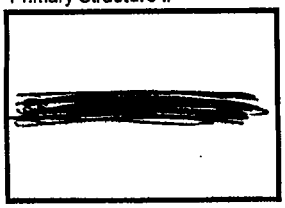
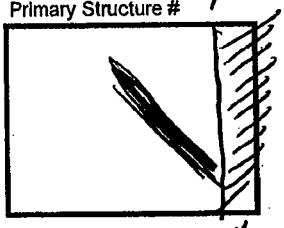


Primary Structure # 5

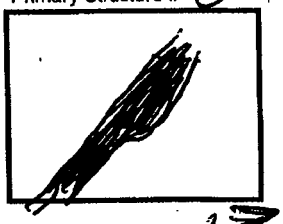


Primary Structure # 6

Primary Structure # 7

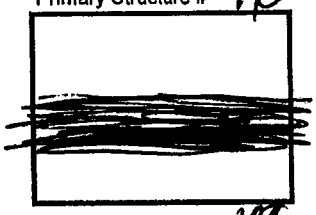


Primary Structure # 8

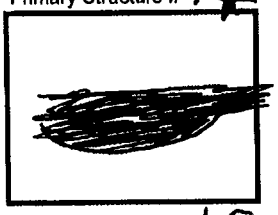


Primary Structure # 9

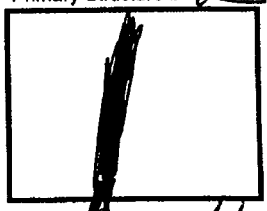
Primary Structure # 10



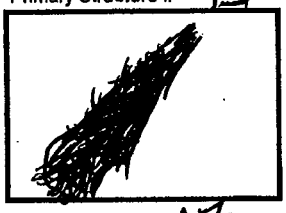
Primary Structure # 11



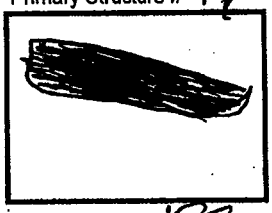
Primary Structure # 12



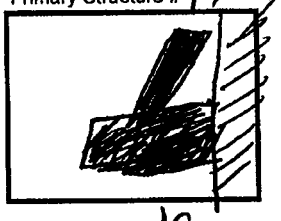
Primary Structure # 13



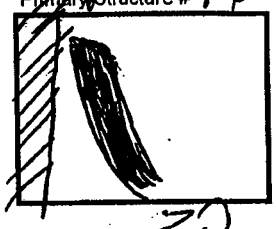
Primary Structure # 14



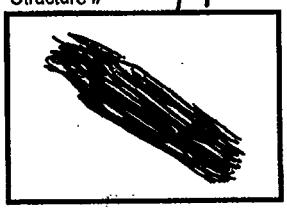
Primary Structure # 15



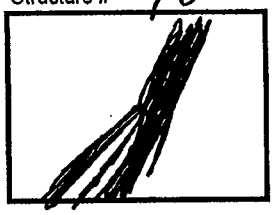
Primary Structure # 16



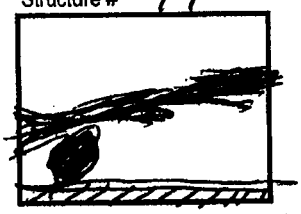
Structure # 17



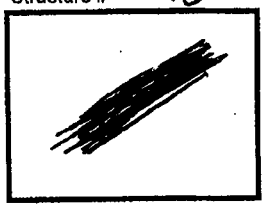
Structure # 18



Structure # 19



Structure # 20



Analyst: KD Date: 7OCT12 Scope: 2

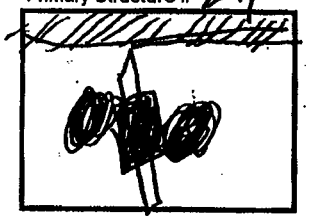
TEM ISO 10312

Structure Sketch Sheet

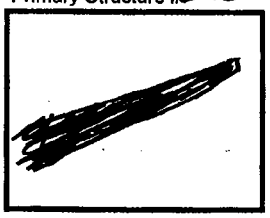
EMSL Order ID: 09121943-0043 **Client:**

Client Sample: _____ Page 2 of 2

Primary Structure # 21



Primary Structure # 22



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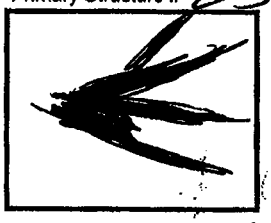

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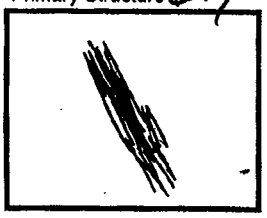

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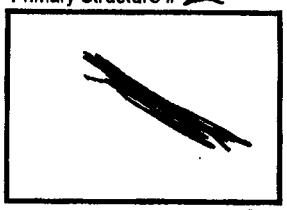

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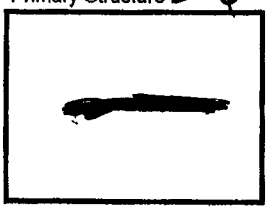

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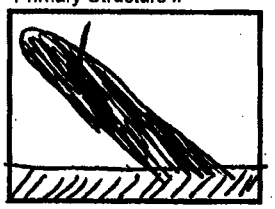

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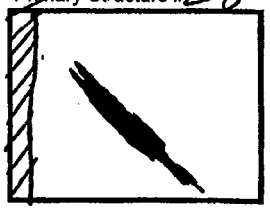
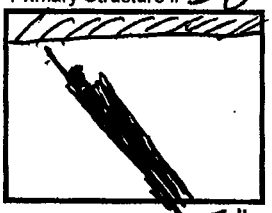


Primary Structure # 29

Primary Structure # 30



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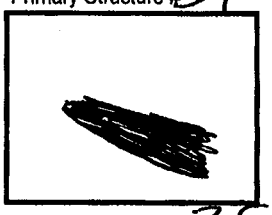

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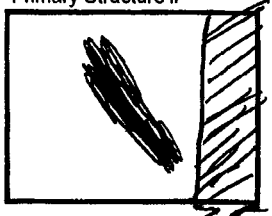
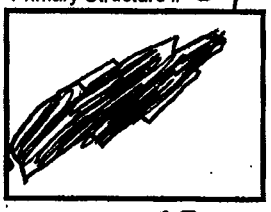


Primary Structure # 33

Primary Structure # 34



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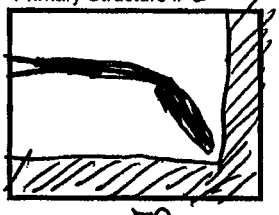

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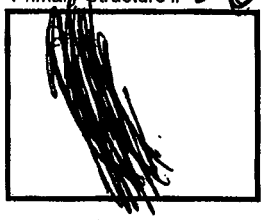
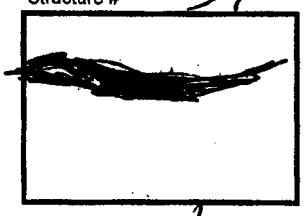
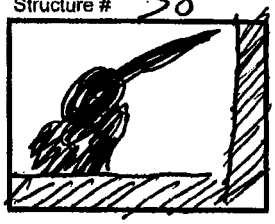


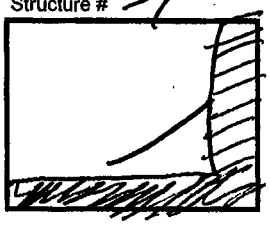
Structure # 37



Structure # 38



Structure # 39



Structure #

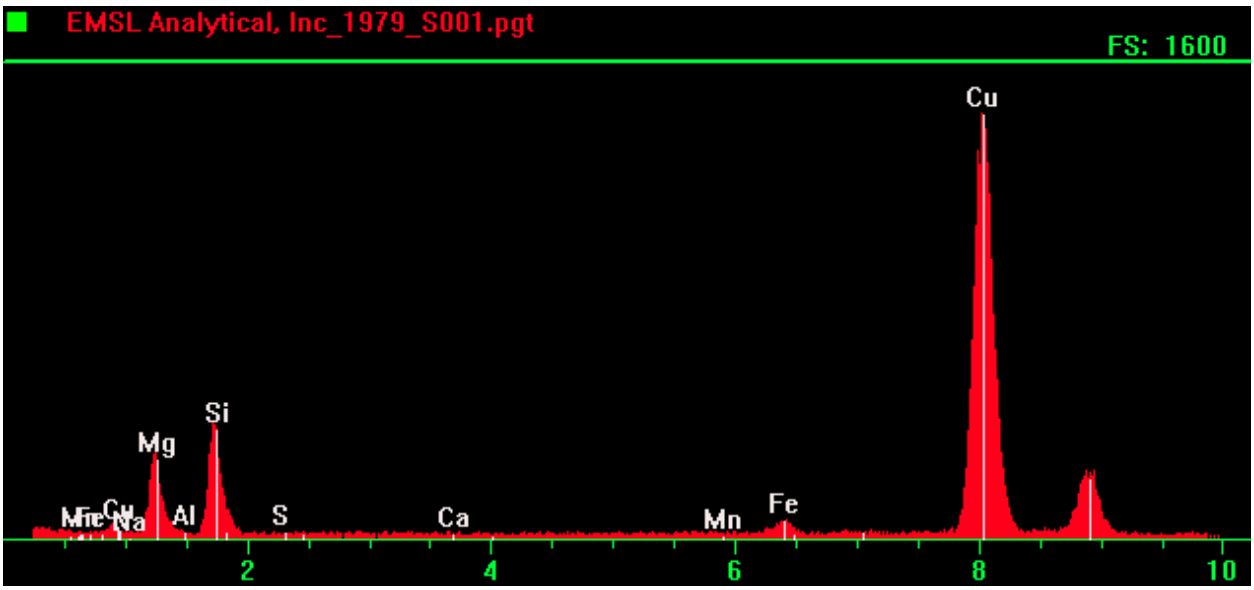
Analyst: KD Date: 7OCT12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0043_TEM_ISO_10312_EDX_Chrysotile
Collected: October 07, 2012 11:50:46

Live Time:	32.56	Count Rate:	3535	Dead Time:	41.00 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



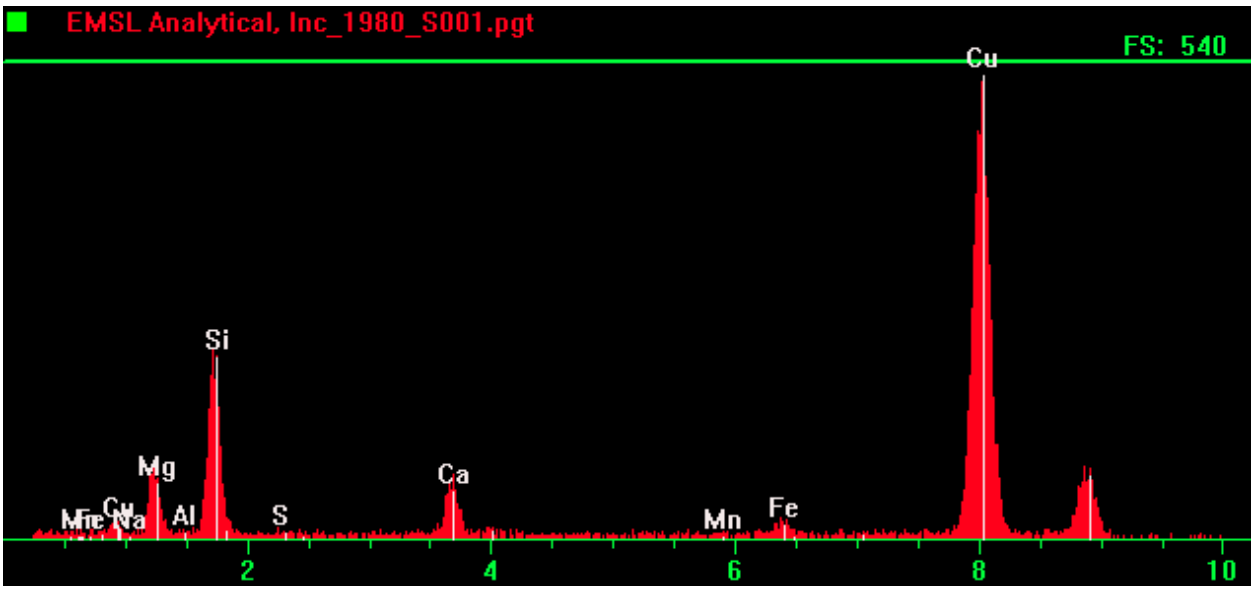
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	13.8	13.9	0.0	0.0
Mg	KA1	163.4	15.5	147.9	9.6
Al	KA1	17.7	16.0	1.8	0.1
Si	KA1	231.3	15.6	215.6	13.8
S	KA1	12.9	13.6	0.0	0.0
Ca	KA1	15.1	13.0	2.1	0.2
Mn	KA1	19.5	17.4	2.1	0.1
Fe	KA1	52.3	19.3	32.8	1.7
Cu	KA1	1342.0	25.2	1316.8	52.4

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0043_TEM_ISO_10312_EDX_Actinolite
Collected: October 07, 2012 12:50:58

Live Time:	54.70	Count Rate:	680	Dead Time:	8.67 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	2.4	2.6	0.0	0.0
Mg	KA1	25.7	2.6	23.1	8.8
Al	KA1	3.0	2.8	0.2	0.1
Si	KA1	73.6	2.4	71.2	30.0
S	KA1	2.9	2.0	0.9	0.5
Ca	KA1	25.1	2.5	22.6	9.1
Mn	KA1	3.5	3.1	0.5	0.2
Fe	KA1	10.1	3.4	6.7	2.0
Cu	KA1	260.7	3.6	257.1	72.1

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 44008 SCOPE #: 2

Reference / Sample Number: 43

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.49 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.25	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	5.33	5.30	5.035	5.565
Angle to 110 reflection (Measured °)	62	60	57.000	63.000
d2 or d hk 0 (002) (Angstroms)	7.25	7.32	6.954	7.686
d1 or d hk 1 (110) (Angstroms)	4.56	4.58	4.351	4.809

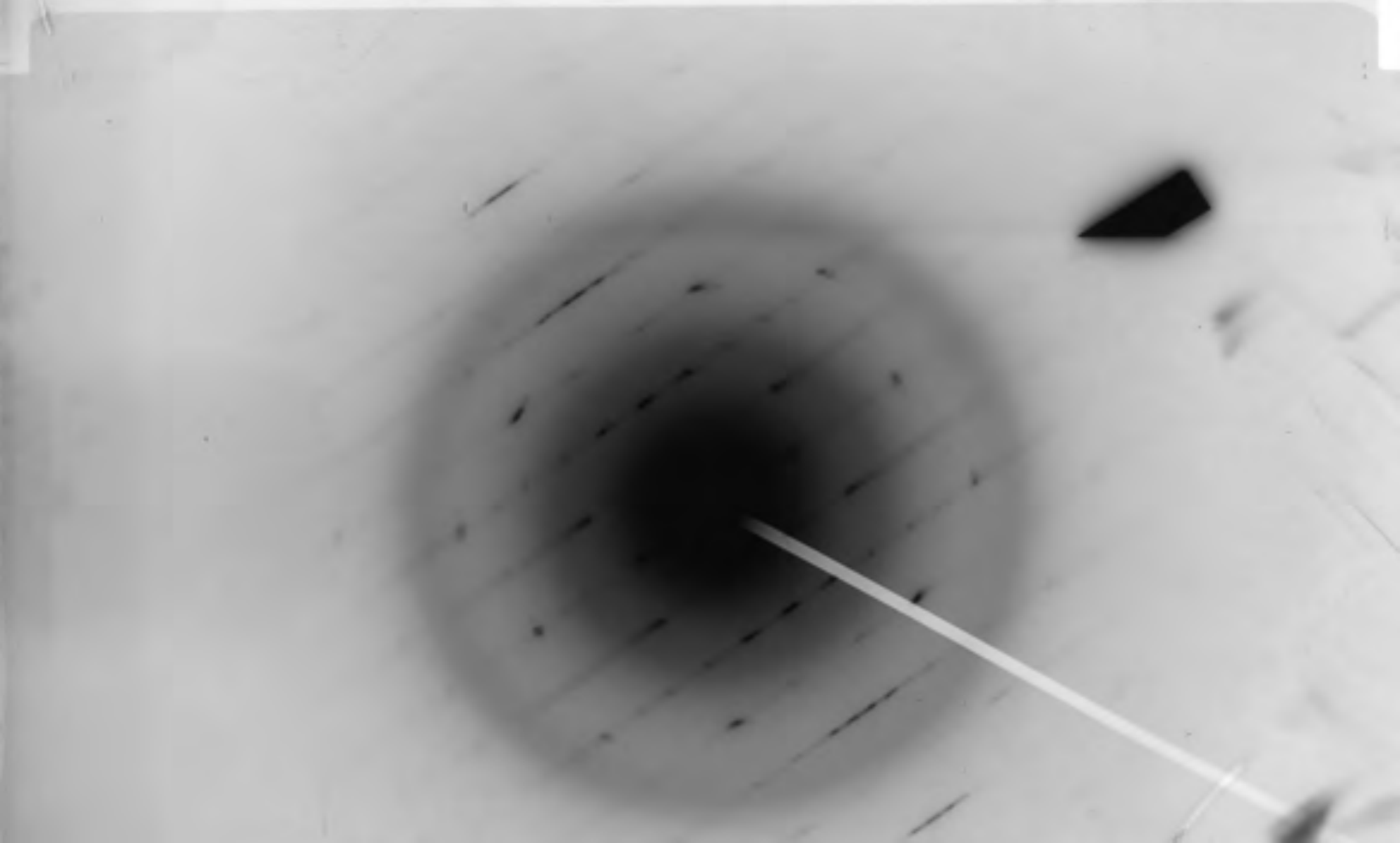
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9844008



EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 44007 SCOPE # 2

Reference / Sample Number: 43

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.55 mm
Mean Distance between spots on Center row (d2): 5.25 mm
Mean distance between spots on slant vector (d1): 9.05 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.25**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**4.55**	4.762	**4.524**	**5.000**
d1 or hk1 (Camera K/slant vector dist.)	**2.64**	2.641	**2.509**	**2.773**
Ratio of hk0/hk1	**1.72**	1.80	**1.710**	**1.890**
Angle of Slant Vector (Measured)	88.0	89.0	**84.550**	**93.450**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [0 2 1]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

1094001

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0044**	Volume (L):	768	Scope:	09-02
Customer Sample:	HM-OP-MB-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	C, 1-3	Analysis Date:	10/7/2012

Analysis Information

Target Sensitivity: 0.004 s/cc
GO Required: 10
GO Analyzed: 0
Level of Analysis Chrysotile: CDQ 11/27/12 DM
Level of Analysis Amphibole: ADX DM

Minimum Aspect Ratio: (circle one)
none | 3:1 | 5:1

Min Length: 75 ~~0.5~~ 11/27/12 DM micron
Min Width: ~~0.25~~ ~~NONE~~ micron

Comments:

OVERLOADED
25%

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0044**	Volume (L):	768	Scope:	04-03
Customer Sample:	HM-OP-MB-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~ 0.0129 RD 11-29-12
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	P Harrison
EFA (mm^2):	385	Grid Location:	C, 1-3	Analysis Date:	11/5/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)	**Comments:**
GO Required:	10	none [3:1] 5:1	
GO Analyzed:	10		
Level of Analysis Chrysotile:	CD~~O~~ 11/29/12 bm	Min Length: PH 11/5/12 ~~0.555~~ micron	
Level of Analysis Amphibole:	ADX	Min Width: ~~NONE~~ 0.25 micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
C1	I6	F	0	0	6.5	0.8	NRA	NRA			
↓	G4	F	0	0	5.2	1.3	NRA	NRA		03524	Y
↓	E6	MD11	1		22.0	20.0					
↓	↓	MB		1	5.1	0.3	CD	CH		03525	Y
↓	C3	B	2	2	10.1	0.6	CD	CH			
↓	A5	MB	3	3	~~3.5~~ 27.0 PH 11/5/12	2.0	CD	CH			
C2	A6	MD11	4		22.0	6.0					
↓	↓	MB		4	14.5	0.4	ADX	AC		03526	Y
↓	C3	F	5	5	6.4	0.5	ADX	AC			
↓	E7	CD22	6		21.8	17.0					

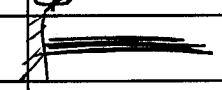
ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0044**	Volume (L):	768	Scope:	04-03
Customer Sample:	HM-OP-MB-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~ 0.0129 RD 11.29.12
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	P Harrison
EFA (mm^2):	385	Grid Location:	C, 1-3	Analysis Date:	11/5/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		***Comments:***
GO Required:	10	none	3:1 5:1	
GO Analyzed:	10			
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM	Min Length:	~~11/5/12 0.555~~ PH micron	
Level of Analysis Amphibole:	ADX	Min Width:	~~NONE~~ 0.25 micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
C2	PH ~~CF~~ E7	CF		6	21.8	2.7	~~ADX~~	AC			
|	11/5/12 ~~CB~~ E7	CB		7	17.0	0.7	CD	CH			
|	↓	MD11	7		16.0	10.0					
|	↓	MB		8	10.5	2.0	CD	CH			
|	G1	B	0	0	11.7	0.7	CD	CH			
↓	I9	NSD									

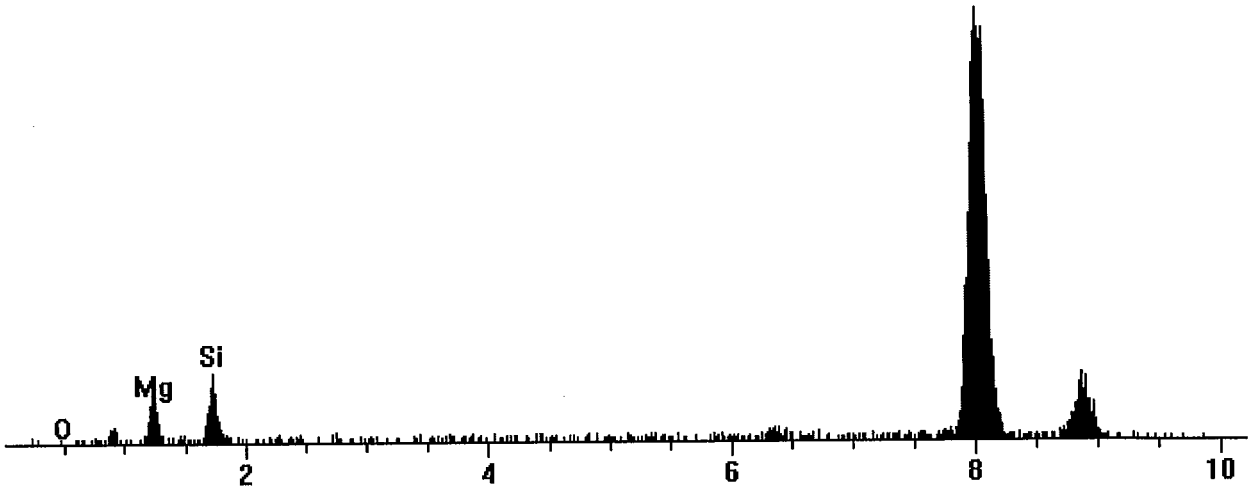
Energy Dispersive X-Ray Analysis Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: L:\EDS Spe...Spectra\Scope 04-03\2012\091211943-0044 C1 E6 1 CH.pgt
Collected: Nov 5, 2012 11:05:19

Live Time:	57.27	Count Rate:	268	Dead Time:	6.01 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	50378.81				

■ **091211943-0044 C1 E6 1 CH.pgt** **FS: 320**



Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.1343	28.62	24.84	35.8	MgO	47.46
Si	KA1	1.740	1.0000	33.47	25.16	36.2	SiO	52.54
O	KA1	0.523	0.0000	37.90	50.00	72.0		
Total			**0.0000**	**100.00**	**100.00**	**144.0**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	7.8	0.6	7.2
Si	KA1	10.2	0.7	9.5
O	KA1	0.5	0.2	0.2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

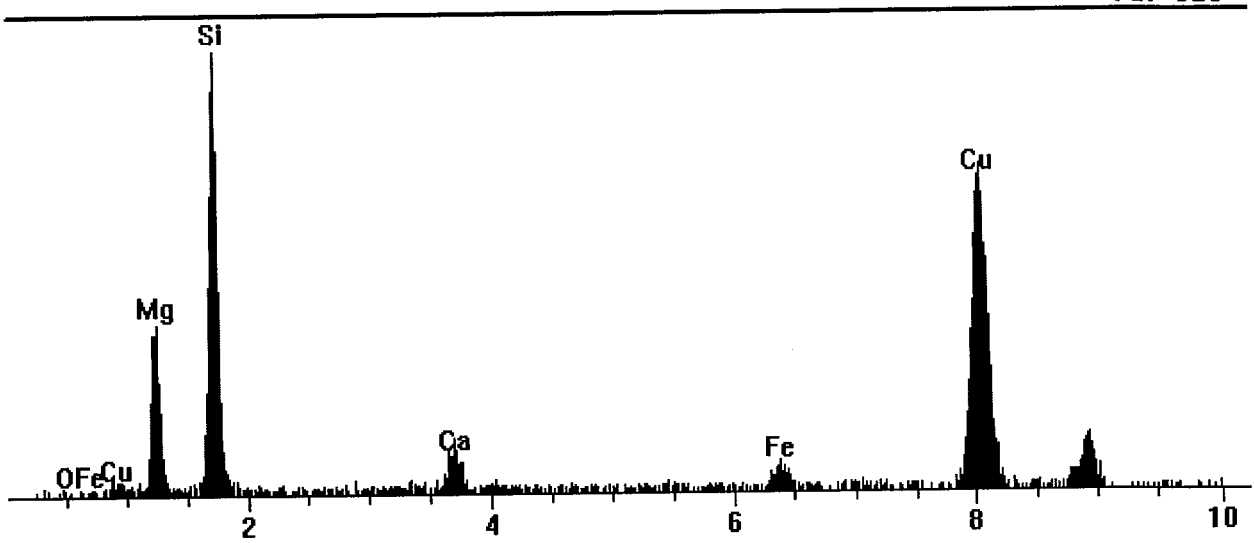
EMSL ANALYTICAL, INC.

File: L:\EDS Spe...Spectra\Scope 04-03\2012\091211943-0044 C2 A6 4 AC.pgt
Collected: November 05, 2012 12:55:04

Live Time:	92.65	Count Rate:	218	Dead Time:	4.41 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00
Thickness limit:	31283.85				

091211943-0044 C2 A6 4 AC.pgt

FS: 320



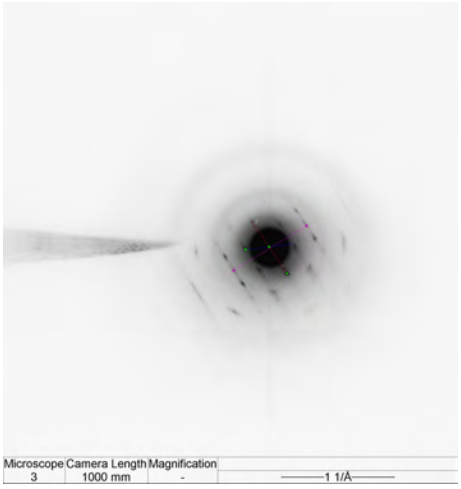
Element	Line	keV	CL Ratio	Wt%	At%	At Prop	Compound	Cmpd Wt%
Mg	KA1	1.254	1.7200	20.86	19.07	27.5	MgO	34.58
Si	KA1	1.740	1.0000	32.80	25.97	37.4	SiO	51.48
Ca	KA1	3.691	1.1400	5.25	2.92	4.2	CaO	7.35
Fe	KA1	6.403	1.5300	5.12	2.04	2.9	FeO	6.59
Cu	KA1	8.046	0.0000	0.00	0.00	0.0		
O	KA1	0.523	0.0000	35.97	50.00	72.0		
Total			**0.0000**	**100.00**	**100.00**	**144.0**	**Total**	**100.00**

Element	Line	Gross (cps)	BKG (cps)	Net (cps)
Mg	KA1	16.6	1.0	15.6
Si	KA1	43.3	1.0	42.3
Ca	KA1	6.8	0.8	5.9
Fe	KA1	5.4	1.1	4.3
Cu	KA1	59.7	1.1	58.6
O	KA1	0.5	0.3	0.2

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number:	091211943	**Date:**	Nov 05, 2012
Image Number:	03525		
Reference / Sample Number:	0044		
Preliminary ID:	Chrysotile		
Camera Constant:	1.9639471	**1/A Pixels**	
Calibration Reference:	110512-04-03-03523_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.287**	5.3	**5.06**	**5.56**
Vector Angle:	**59.3**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.264**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.620**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

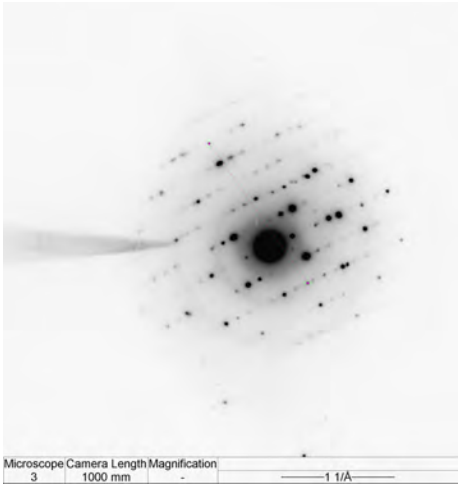
Preliminary Identification was:

X	CORRECT
	INCORRECT

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number:	091211943	**Date:**	Nov 05, 2012
Image Number:	03526		
Reference / Sample Number:	0044		
Preliminary ID:	ACTINOLITE		
Camera Constant:	1.964e-003	**1/A Pixels**	
Calibration Reference:	110512-04-03-03523_C		

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.295**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**N/A**	N/A	**-**	**-**
d1 or hkl (Camera K/slant vector dist.):	**N/A**	N/A	**-**	**-**
Ratio of hk0/hkl:	**N/A**	N/A	**-**	**-**
Vector Angle:	**N/A**	N/A	**-**	**-**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: [**N/A**]

Preliminary Identification was:

X	CORRECT
	INCORRECT

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-0045**	Volume (L):	726	Scope:	09-02
Customer Sample:	HM-OP-HK-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	121002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	C, 4-6	Analysis Date:	10/7/2012

Analysis Information

Target Sensitivity: 0.004 s/cc
GO Required: 11
GO Analyzed: 11
Level of Analysis Chrysotile: CD~~Ø~~ 11/27/12 DM
Level of Analysis Amphibole: ADX

Minimum Aspect Ratio: (circle one)
none | 3:1 | 5:1

Min Length: >5 ~~0.5~~ micron
Min Width: 0.25 ~~NONE~~ micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
C4	G1	ND									
C4	G3	B	1	1	8.9	2.1	CD	CHRYS			YES
C4	G3	B	2	2	6.9	1.6	CD	CHRYS			
C4	G3	MD11	3		16.1	4.8	CD	CHRYS			
C4	G3	MB		3	16.1	0.5	CD	CHRYS			
C4	G3	B	4	4	34.2	5.8	CD	CHRYS			
C4	G5	B	5	5	45.8	4.2	CD	CHRYS			
C4	G5	B	6	6	46.1	1.05	CD	CHRYS		43942	
C4	G5	B	7	7	5.4	1.3	CD	CHRYS			
C4	G7	MD11	8		13.6	7.2	ADX	ACTINOLITE			

ISO 10312

091211943-0045

TEM Asbestos Count Sheet

C4	G7	MB		8	8.2	1.1	ADX	ACTINOLITE		44003	YES
C4	G9	B	9	9	13.4	3.6	CD	CHRYS			
C4	G9	B	10	10	16.5	5.4	CD	CHRYS			
C4	G9	B	11	11	20.8	2.8	CD	CHRYS			
C5	D10	B	12	12	33.6	0.96	CD	CHRYS			
C5	D10	B	13	13	10.6	4.3	CD	CHRYS			
C5	D10	B	14	14	8.2	0.25	CD	CHRYS			
C5	D10	B	15	15	9.8	1.3	ADX	ACTINOLITE			
C5	D8	B	16	16	6.05	1.8	CD	CHRYS			
C5	D8	B	17	17	16.8	2.8	CD	CHRYS			
C5	D6	B	18	18	9.6	3.1	CD	CHRYS			
C6	F1	B	19	19	8.8	0.7	CD	CHRYS			
C6	F1	B	20	20	19.6	1.6	ADX	ACTINOLITE			
C6	F3	B	21	21	48.5	6.8	CD	CHRYS			
C6	F5	ND									

ND= None Detected

NAM= Non Asbestos Material

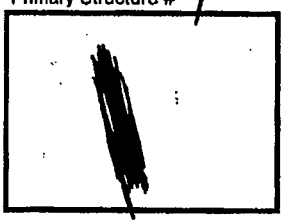
TEM ISO 10312

Structure Sketch Sheet

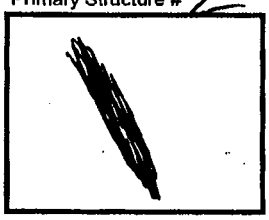
EMSL Order ID: 0912119 43-0045 Client:

Client Sample: Page 1 of 1

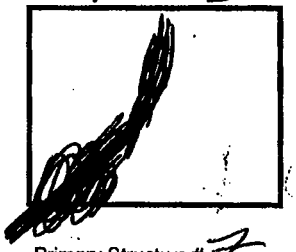
Primary Structure # 1



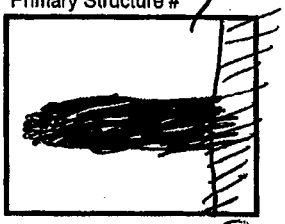
Primary Structure # 2



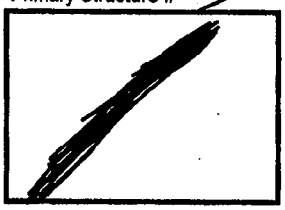
Primary Structure # 3



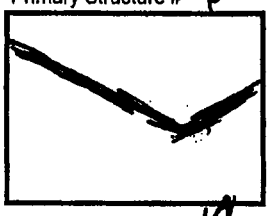
Primary Structure # 4



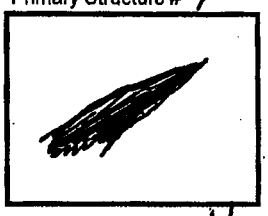
Primary Structure # 5



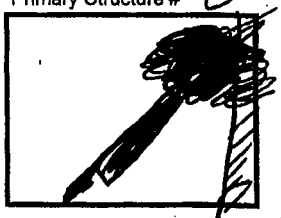
Primary Structure # 6



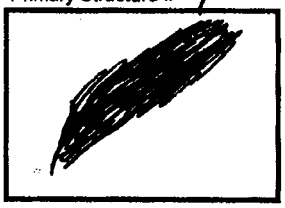
Primary Structure # 7



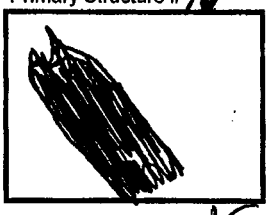
Primary Structure # 8



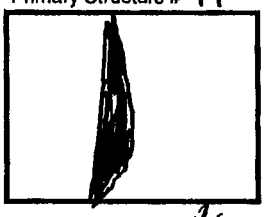
Primary Structure # 9



Primary Structure # 10

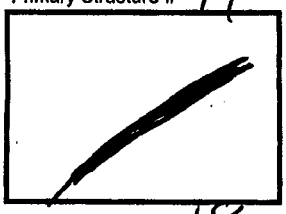


Primary Structure # 11

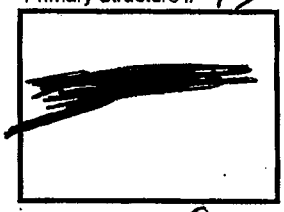


Primary Structure # 12/13

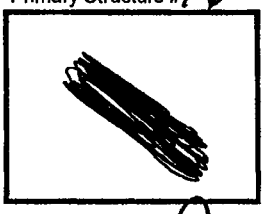
Primary Structure # 14



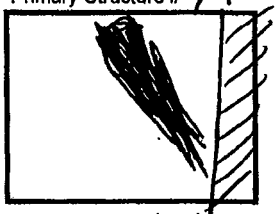
Primary Structure # 15



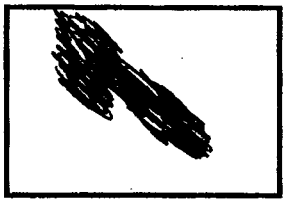
Primary Structure # 16



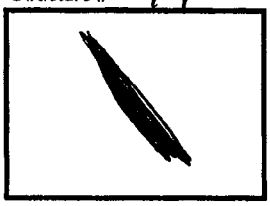
Primary Structure # 17



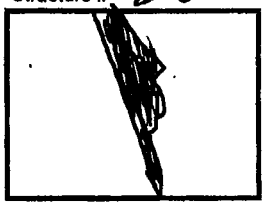
Structure # 18



Structure # 19



Structure # 20



Structure # 21

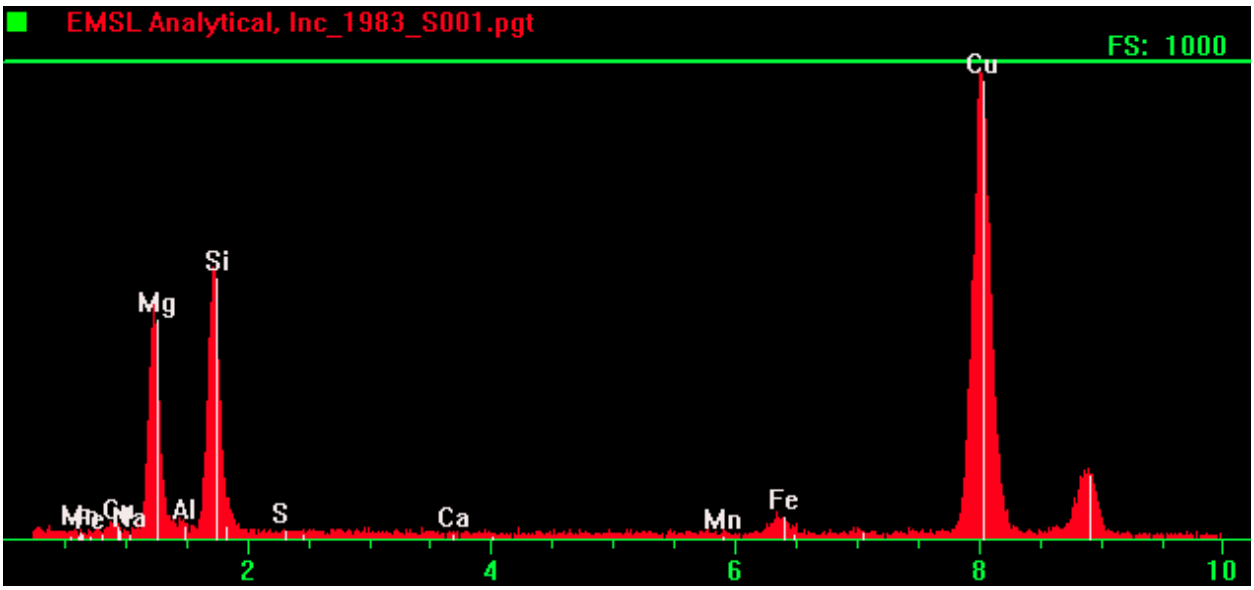
Analyst: KD Date: 7 OCT 12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0045_TEM_ISO_10312_EDX_Chrysotile
Collected: October 07, 2012 14:19:31

Live Time:	41.18	Count Rate:	2186	Dead Time:	25.18 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



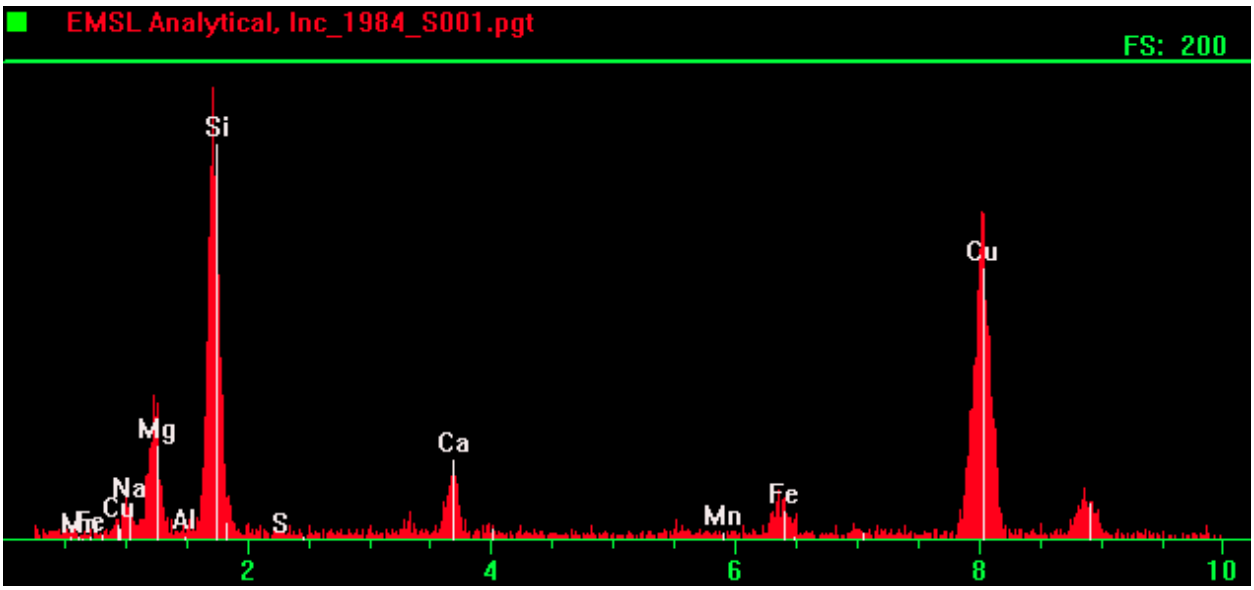
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	9.0	7.8	0.0	0.0
Mg	KA1	210.9	8.7	202.2	23.1
Al	KA1	17.8	9.6	8.2	0.8
Si	KA1	270.9	10.1	260.8	25.8
S	KA1	9.7	9.8	0.0	0.0
Ca	KA1	8.7	8.0	0.7	0.1
Mn	KA1	9.7	9.0	0.7	0.1
Fe	KA1	32.8	9.9	22.8	2.3
Cu	KA1	693.0	11.4	681.7	60.0

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0045_TEM_ISO_10312_EDX_Actinolite
Collected: October 07, 2012 14:37:36

Live Time:	27.79	Count Rate:	555	Dead Time:	6.99 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	8.5	2.6	5.6	2.1
Mg	KA1	35.4	2.6	32.8	12.7
Al	KA1	3.8	2.7	1.1	0.4
Si	KA1	121.4	2.8	118.5	42.2
S	KA1	2.1	1.9	0.2	0.1
Ca	KA1	20.9	2.3	18.5	7.9
Mn	KA1	2.7	1.3	1.4	1.1
Fe	KA1	16.9	1.3	15.4	11.6
Cu	KA1	130.6	2.8	127.8	45.5

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43942 SCOPE #: 2

Reference / Sample Number: 45

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	58	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

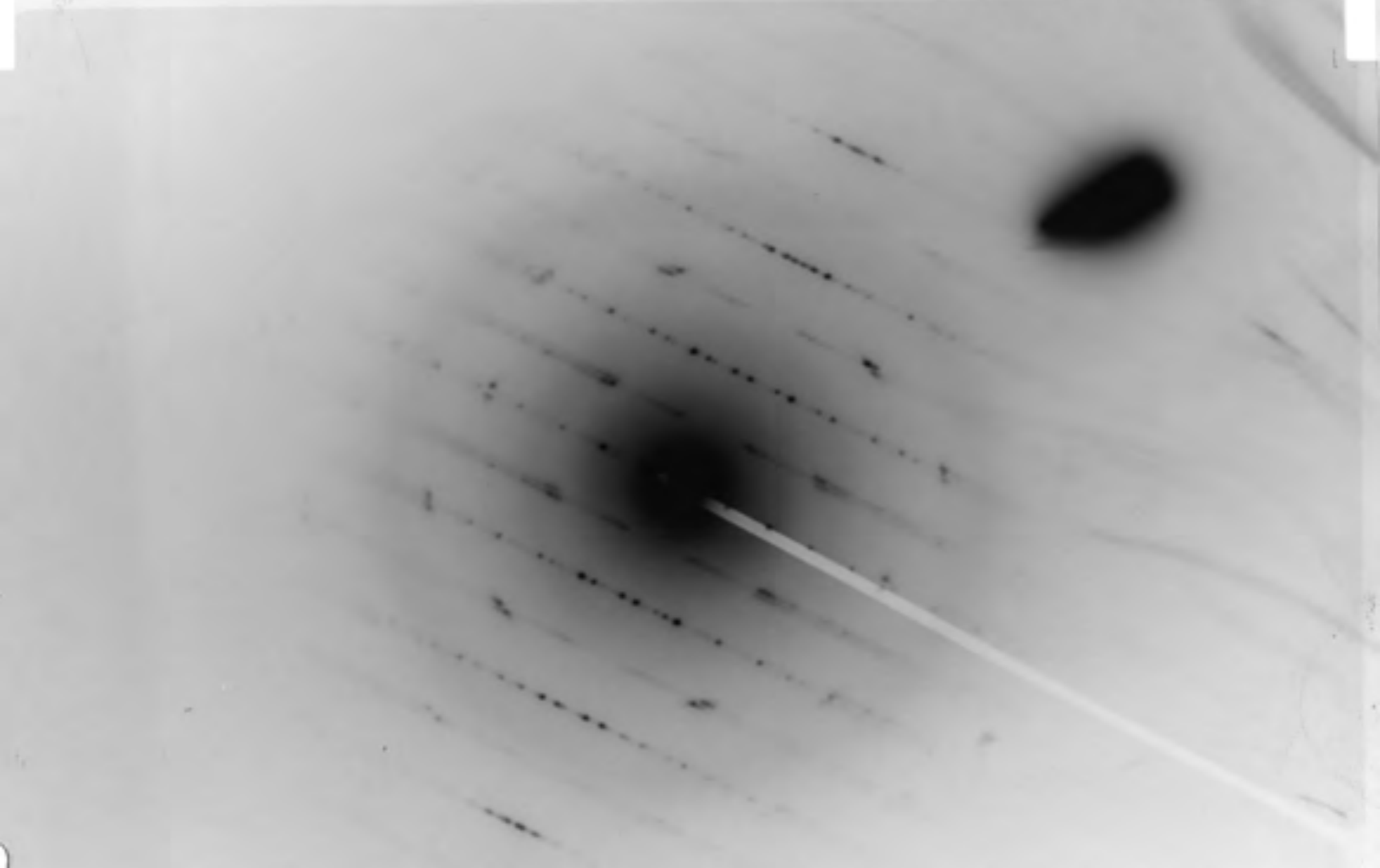
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9843942



EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 44003 SCOPE # 2

Reference / Sample Number: 45

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.5 mm
Mean Distance between spots on Center row (d2): 4.6 mm
Mean distance between spots on slant vector (d1): 4.9 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.31**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**5.19**	5.099	**4.844**	**5.354**
d1 or hk1 (Camera K/slant vector dist.)	**4.88**	4.931	**4.684**	**5.178**
Ratio of hk0/hk1	**1.07**	1.03	**0.979**	**1.082**
Angle of Slant Vector (Measured)	65.0	68.0	**64.600**	**71.400**

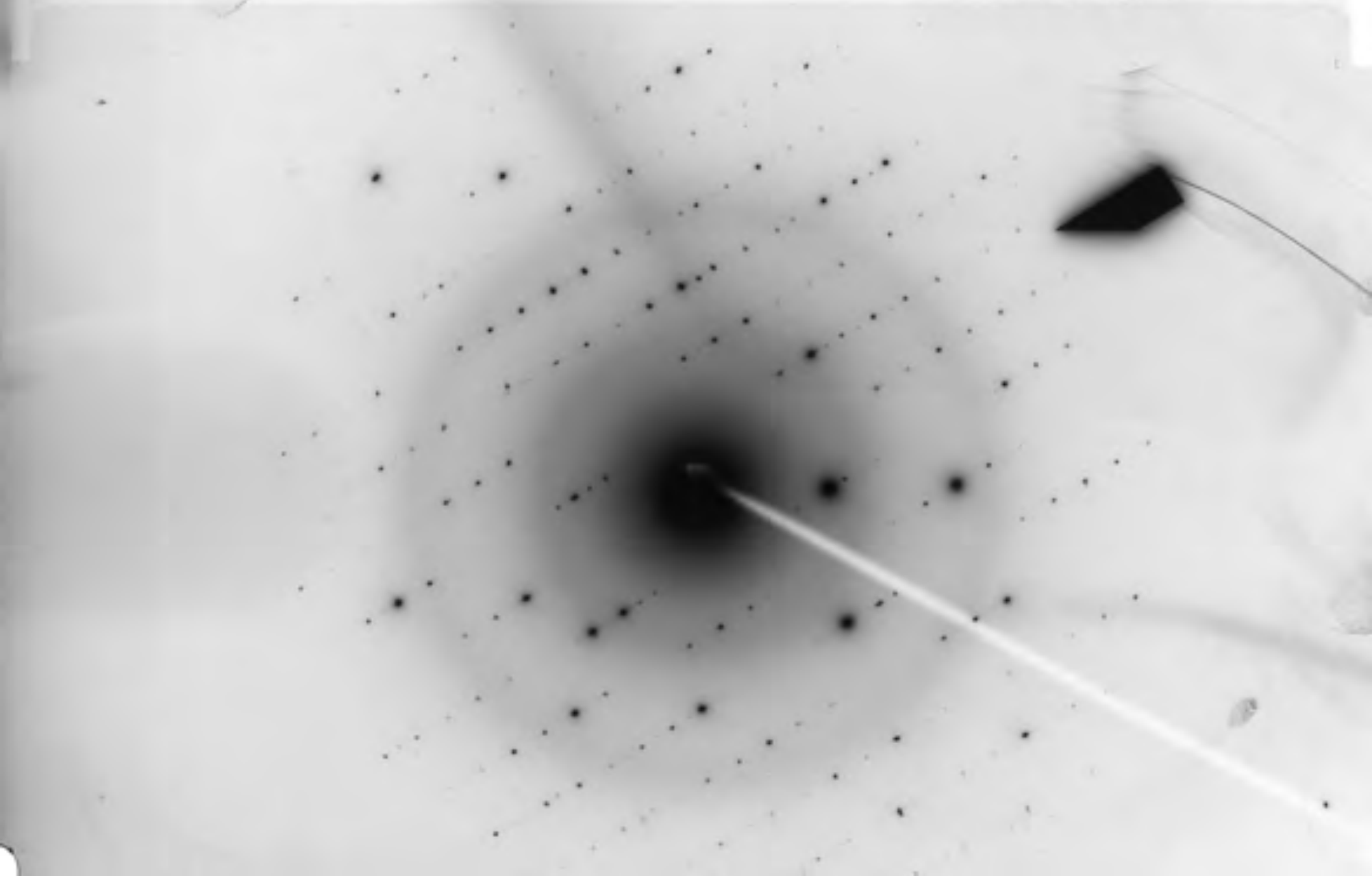
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [3 1 2]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

1044003



ISO 10312

TEM Asbestos Count Sheet

11/27/12 DYM

EMSL Sample ID:	0912111943-0046	Volume (L):	772	Scope:	09-02
Customer Sample:	HM-OP-HK-02	Prepped By:	PK	19-Sep GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	D, 1-3	Analysis Date:	10/7/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	10		none	3:1	5:1
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 DYM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
D1	F10	B	1	1	5.5	1.5	CD	CHRYS		43998	
D1	F10	B	2	2	7.2	2.1	CD	CHRYS			
D1	F10	B	3	3	10	2.5	CD	CHRYS			
D1	F8	B	4	4	35	4.3	CD	CHRYS			
D1	F8	B	5	5	7.4	2.3	CD	CHRYS			
D1	F6	B	6	6	15.6	0.5	CD	CHRYS			YES
D1	F6	B	7	7	22.4	1.8	CD	CHRYS			
D1	F4	B	8	8	14.8	2.3	CD	CHRYS			
D2	F1	B	9	9	13.6	3.1	CD	CHRYS			
D2	F1	B	10	10	10.2	2.2	CD	CHRYS			

ISO 10312

091211943-0046

TEM Asbestos Count Sheet

D2	F1	B	11	11	5.2	0.55	CD	CHRYS			
D2	F3	B	12	12	7.6	1.5	CD	CHRYS			
D2	F5	MD11	13		11.8	3.2	CD	CHRYS			
D2	F5	MB		13	7.8	2.1	CD	CHRYS			
D2	F5	B	14	14	21.6	3.1	CD	CHRYS			
D2	F5	B	15	15	9.05	3.15	CD	CHRYS			
D2	F5	B	16	16	5.15	1.6	CD	CHRYS			
D3	F1	B	17	17	19.6	0.8	ADX	ACTINOLITE		43997	Yes
D3	F1	B	18	18	15.2	2.6	CD	CHRYS			
D3	F3	B	19	19	14.1	3.2	CD	CHRYS			
D3	F3	B	20	2	8.2	0.8	CD	CHRYS			
D3	F5	B	21	21	12.1	2.3	CD	CHRYS			
D3	F5	B	22	22	13.15	1.5	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

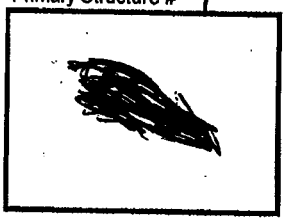
EMSL Order ID: 091211943-0046

Client:

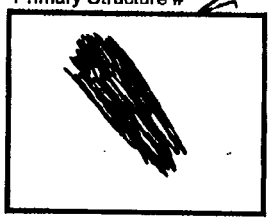
Client Sample:

Page 1 of 2

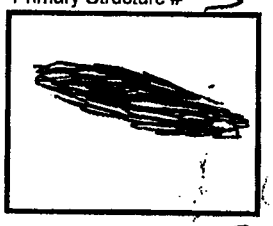
Primary Structure # 1



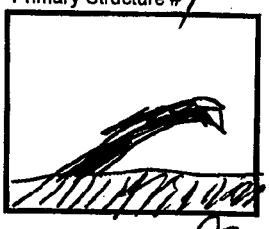
Primary Structure # 2



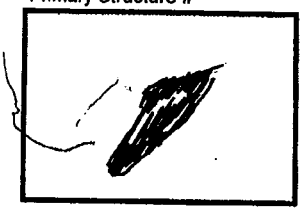
Primary Structure # 3



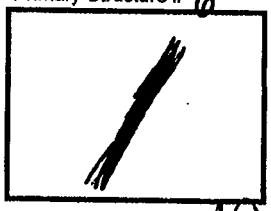
Primary Structure # 4



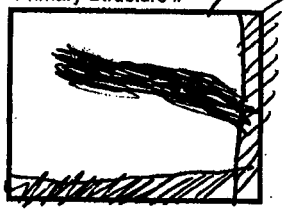
Primary Structure # 5



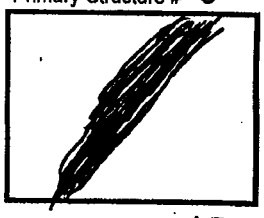
Primary Structure # 6



Primary Structure # 7

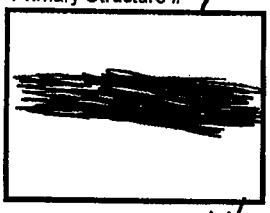


Primary Structure # 8

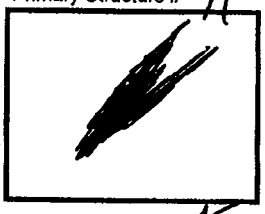


Primary Structure # 9

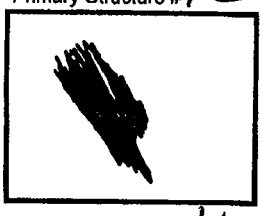
Primary Structure # 10



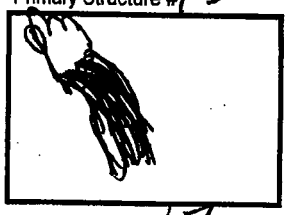
Primary Structure # 11



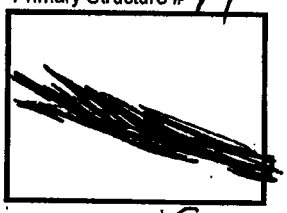
Primary Structure # 12



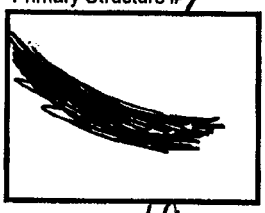
Primary Structure # 13



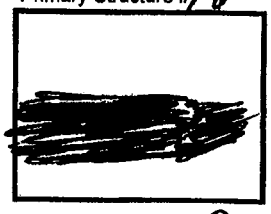
Primary Structure # 14



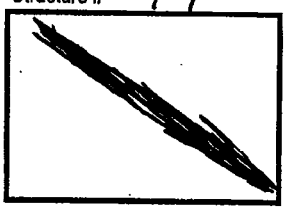
Primary Structure # 15



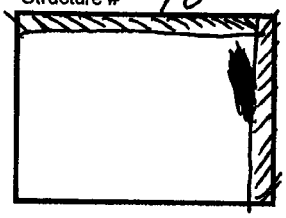
Primary Structure # 16



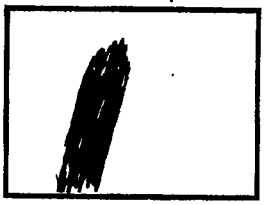
Structure # 17



Structure # 18



Structure # 19



Structure # 20

Analyst: KD

Date: 7OCT12

Scope: 2

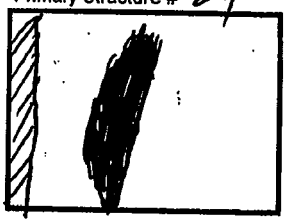
TEM ISO 10312

Structure Sketch Sheet

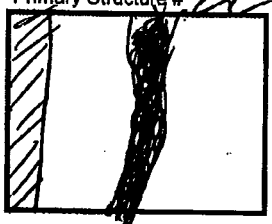
EMSL Order ID: 0912119413-0016 **Client:**

Client Sample: _____ Page 2 of 2

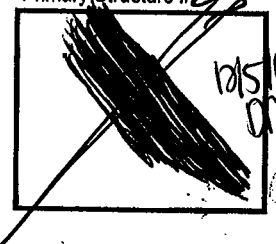
Primary Structure # 21



Primary Structure # 22



Primary Structure # 23



12/5/12 am

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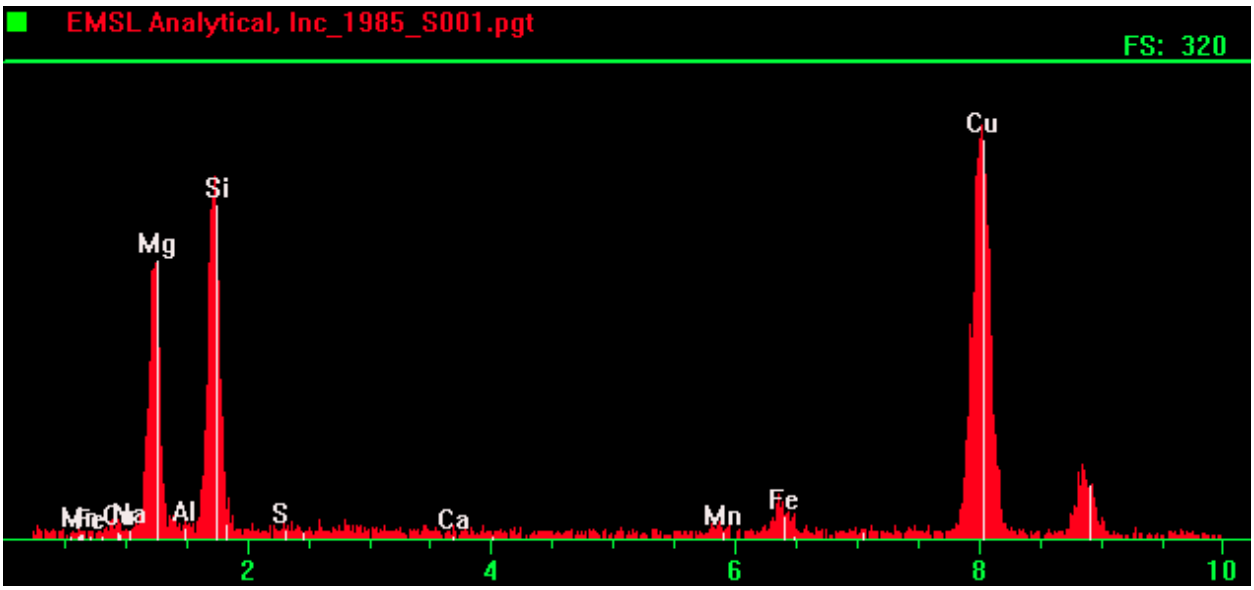
Analyst: KD Date: 7/01/12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0046_TEM_ISO_10312_EDX_Chrysotile
Collected: October 07, 2012 17:14:40

Live Time:	40.26	Count Rate:	724	Dead Time:	8.71 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



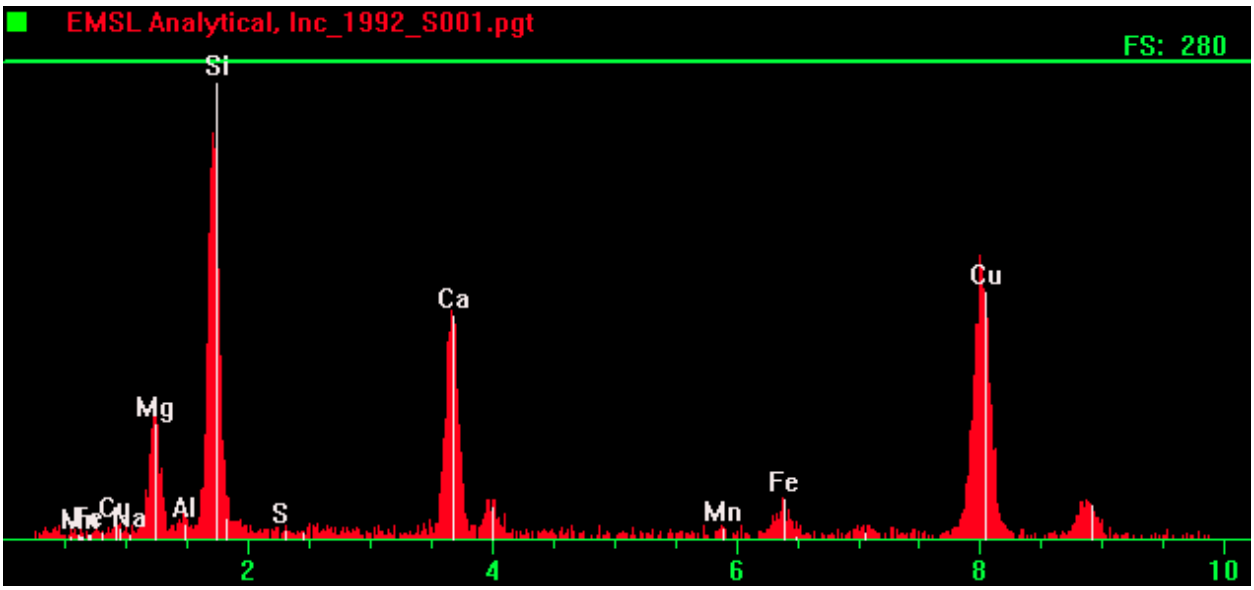
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.3	2.6	0.2	0.1
Mg	KA1	81.5	3.0	78.4	25.9
Al	KA1	4.9	3.7	1.1	0.3
Si	KA1	116.5	3.9	112.6	28.5
S	KA1	3.8	3.4	0.5	0.1
Ca	KA1	3.7	2.4	1.3	0.5
Mn	KA1	5.8	2.6	3.2	1.2
Fe	KA1	14.9	2.8	11.8	4.3
Cu	KA1	199.8	2.9	196.9	67.7

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0046_TEM_ISO_10312_EDX_Actinolite
Collected: October 08, 2012 11:54:54

Live Time:	32.57	Count Rate:	719	Dead Time:	8.54 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	2.6	3.9	0.0	0.0
Mg	KA1	41.3	5.3	36.0	6.9
Al	KA1	8.4	5.2	3.3	0.6
Si	KA1	147.0	5.5	141.5	25.7
S	KA1	3.6	3.4	0.2	0.1
Ca	KA1	88.8	2.8	86.1	31.2
Mn	KA1	3.2	2.2	1.0	0.5
Fe	KA1	16.2	2.3	13.8	6.1
Cu	KA1	133.0	2.4	130.6	54.5

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 43998 SCOPE #: 2

Reference / Sample Number: 46

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

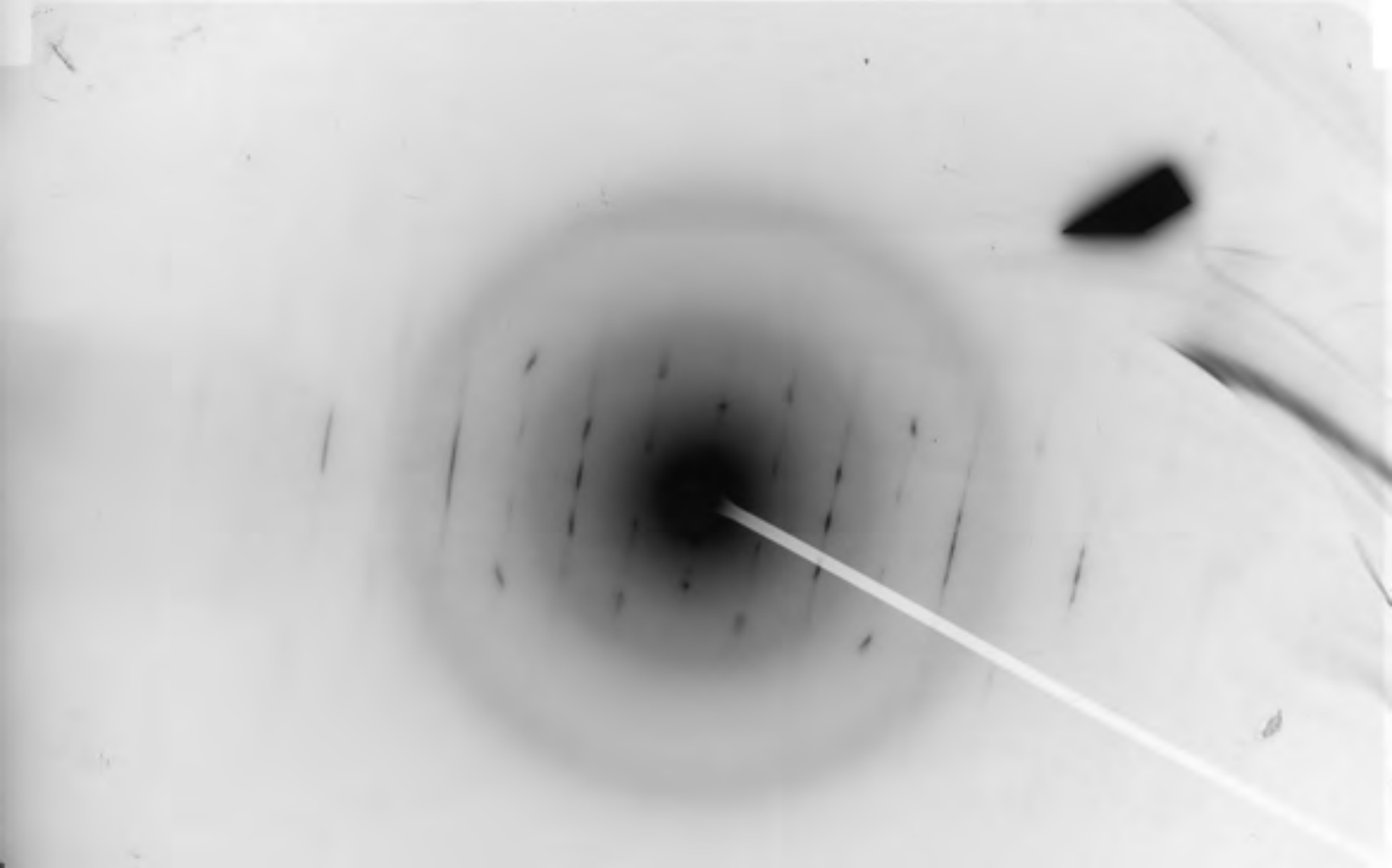
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9843998



EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 43997 SCOPE # 2

Reference / Sample Number: 46

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.55 mm
Mean Distance between spots on Center row (d2): 2.88 mm
Mean distance between spots on slant vector (d1): 5.4 mm

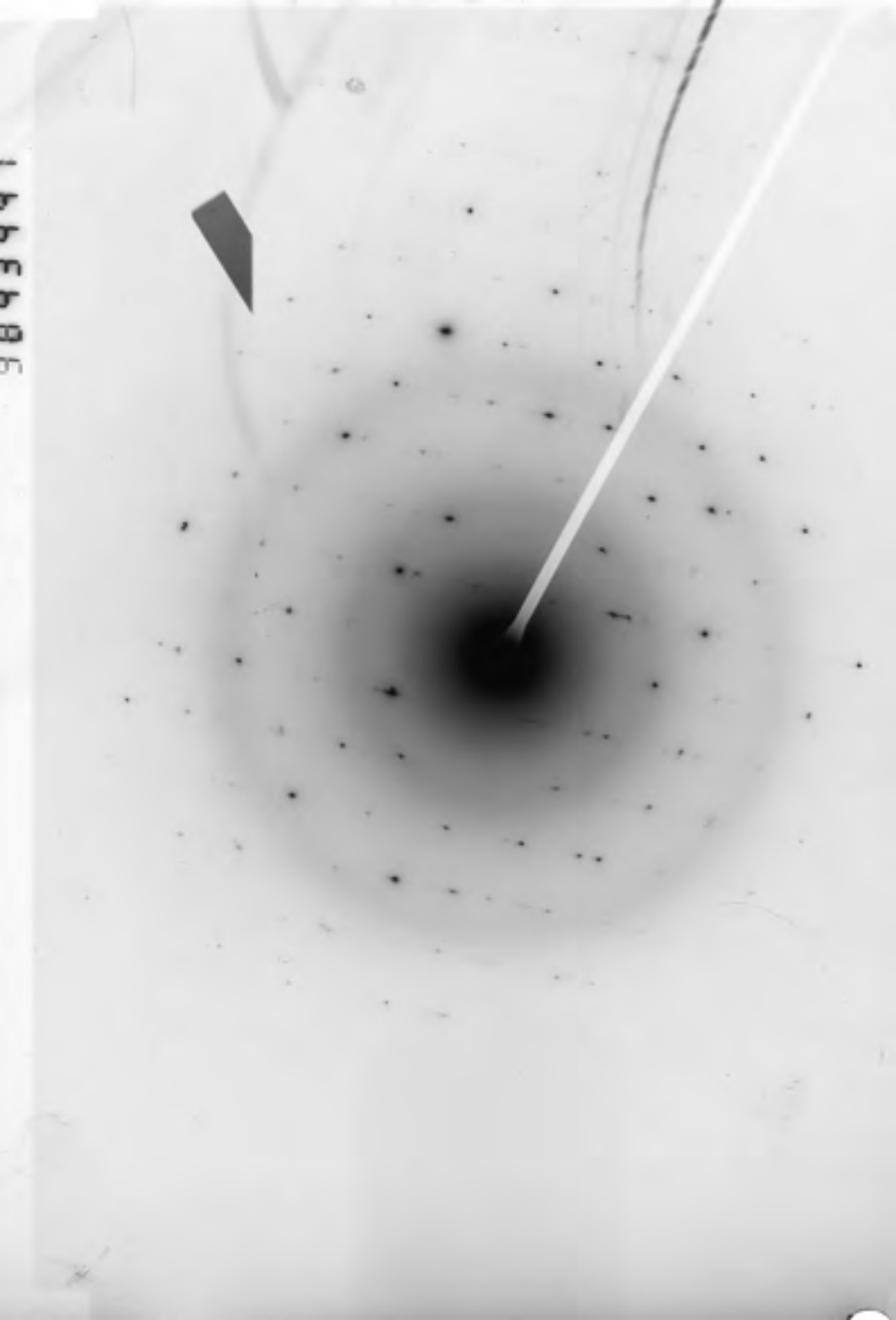
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.25**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**8.30**	8.429	**8.008**	**8.850**
d1 or hk1 (Camera K/slant vector dist.)	**4.42**	4.482	**4.258**	**4.706**
Ratio of hk0/hk1	**1.88**	1.88	**1.786**	**1.974**
Angle of Slant Vector (Measured)	62.0	64.6	**61.370**	**67.830**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [3 -1 4]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0047 (11/27/12 KDM)	Volume (L):	717	Scope:	09-02
Customer Sample:	HM-OP-HK-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	D, 4-5	Analysis Date:	10/8/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ (11/27/12 KDM)	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
D4	D3	B	1	1	7.1	1	CD	CHRYS			
D4	D5	B	2	2	6.6	0.25	CD	CHRYS		43948	
D4	D7	B	3	3	5.2	1.4	CD	CHRYS			YES
D4	D9	ND									
D5	E10	ND									
D5	E8	ND									
D5	E6	ND									
D6	E5	B	4	4	14.5	0.9	CD	CHRYS			
D6	E5	B	5	5	6.05	1.15	ADX	ACTINOLITE		43950	YES
D6	E5	B	6	6	7.3	1.9	ADX	ACTINOLITE			
D6	E3	ND									
D6	E1	B	7	7	7.5	1.6	CD	CHRYS			
D6	F7	ND									

ND= None Detected

NAM= Non Asbestos Material

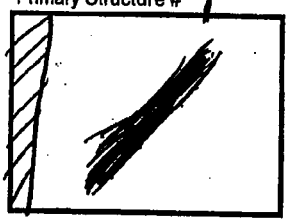
TEM ISO 10312

Structure Sketch Sheet

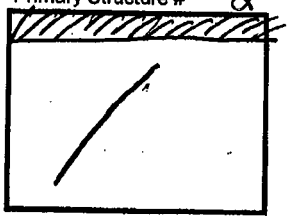
EMSL Order ID: 091211943-0017 **Client:**

Client Sample: _____ Page 1 of 1

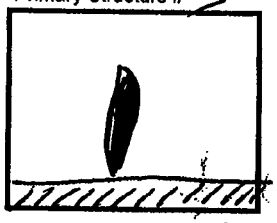
Primary Structure # 1



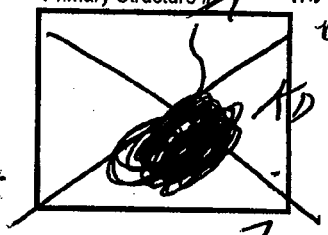
Primary Structure # 2



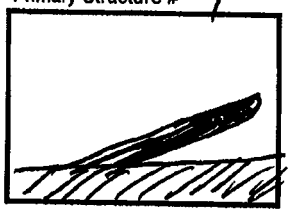
Primary Structure # 3



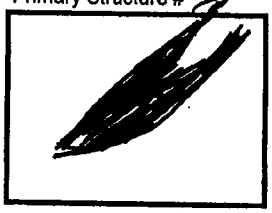
Primary Structure # ~~4~~ 11/27/12 OM



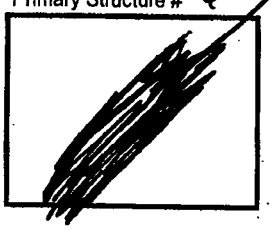
Primary Structure # 4



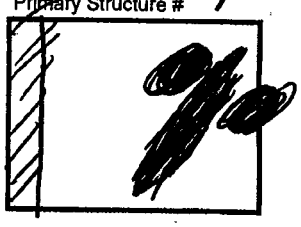
Primary Structure # 5



Primary Structure # 6



Primary Structure # 7



Primary Structure #

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Structure #

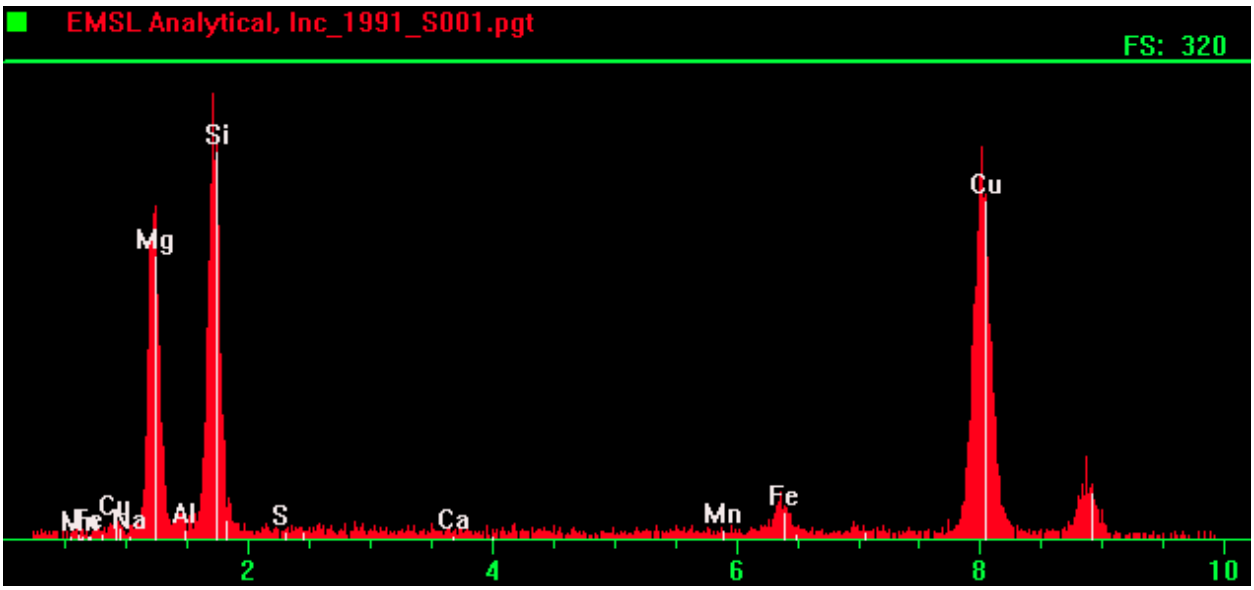
Analyst: KD Date: 8 OCT 12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0047_TEM_ISO_10312_EDX_Chrysotile
Collected: October 08, 2012 13:51:17

Live Time:	35.96	Count Rate:	847	Dead Time:	10.21 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



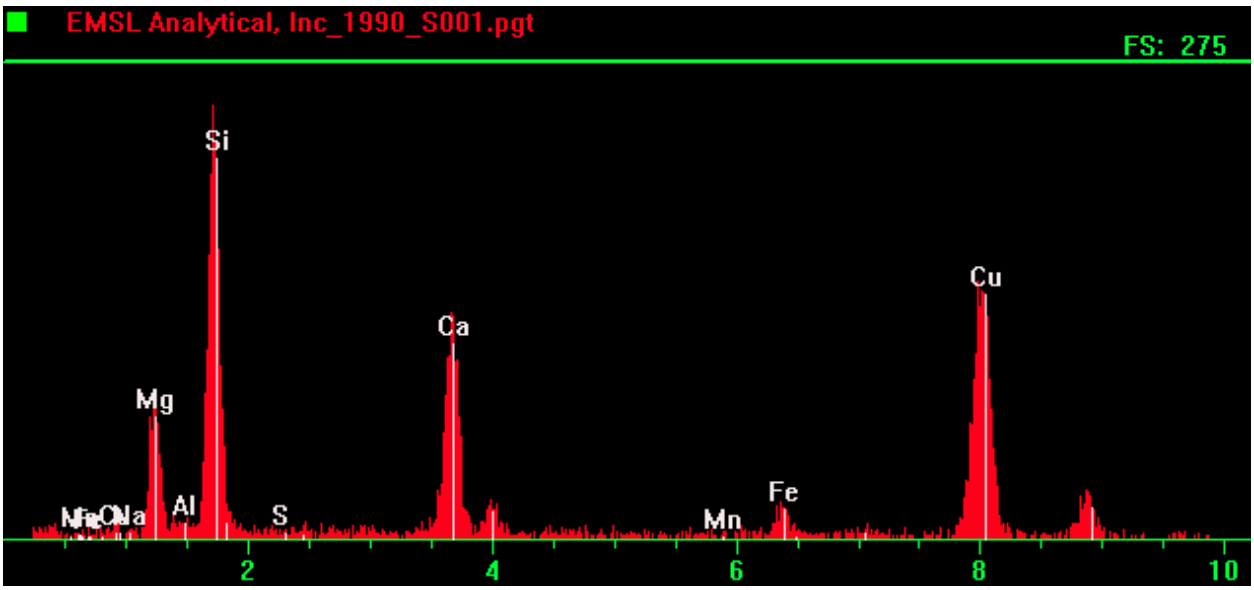
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.9	3.3	0.0	0.0
Mg	KA1	109.7	3.6	106.1	29.6
Al	KA1	8.2	4.0	4.2	1.0
Si	KA1	153.0	4.4	148.6	33.6
S	KA1	4.6	3.8	0.8	0.2
Ca	KA1	3.9	2.5	1.4	0.6
Mn	KA1	4.4	3.3	1.1	0.3
Fe	KA1	18.5	4.1	14.3	3.5
Cu	KA1	203.1	3.3	199.8	61.4

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0047_TEM_ISO_10312_EDX_Actinolite
Collected: October 08, 2012 13:34:42

Live Time:	48.14	Count Rate:	479	Dead Time:	5.98 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	2.0	1.9	0.0	0.0
Mg	KA1	27.9	2.5	25.4	10.0
Al	KA1	3.8	2.5	1.3	0.5
Si	KA1	96.7	2.8	93.9	33.7
S	KA1	2.1	2.3	0.0	0.0
Ca	KA1	61.4	1.9	59.6	31.9
Mn	KA1	1.8	1.5	0.3	0.2
Fe	KA1	10.2	1.5	8.7	5.6
Cu	KA1	88.1	1.6	86.5	53.4

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43948 SCOPE #: 2

Reference / Sample Number: 47

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

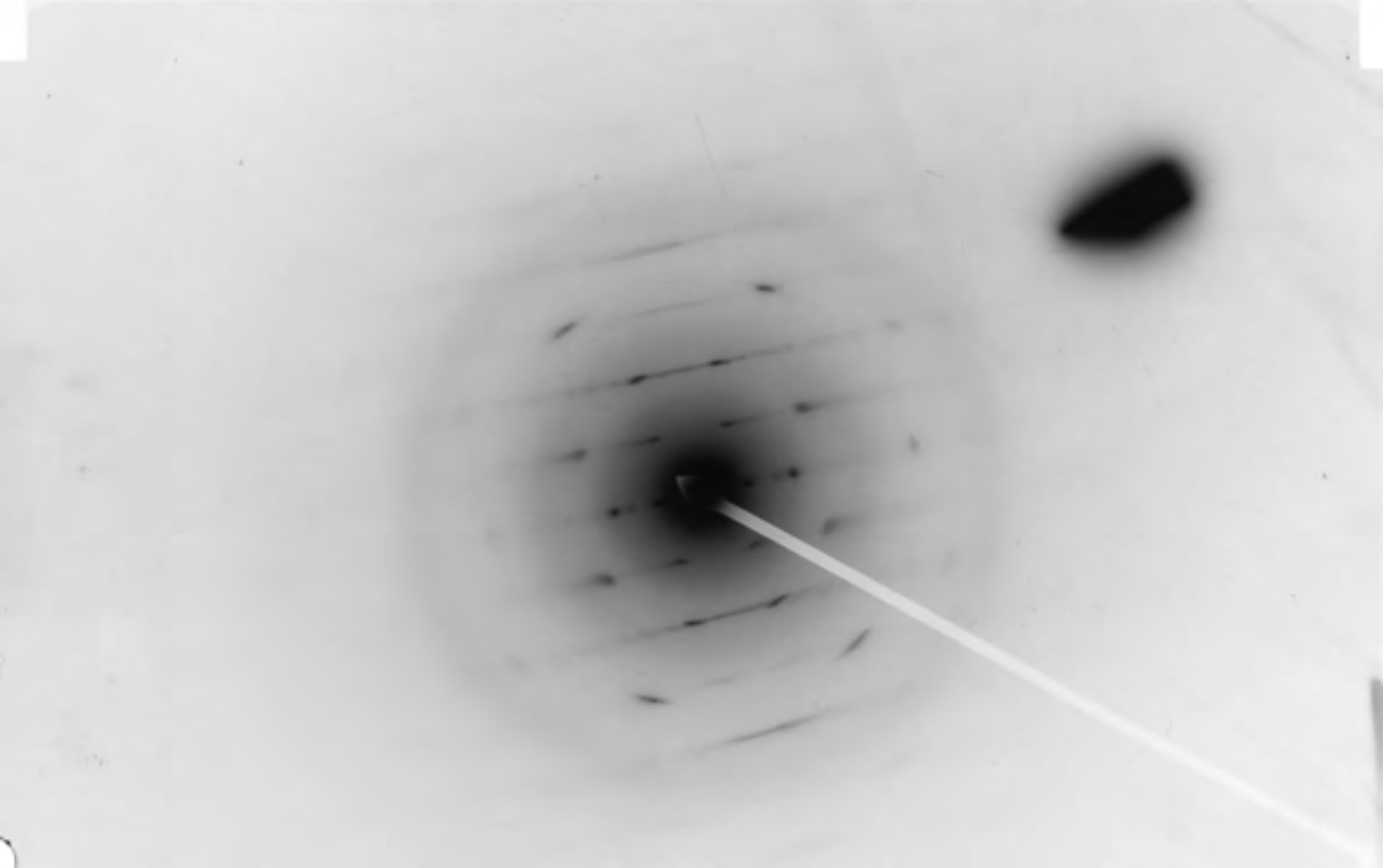
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

5543948



AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43950 SCOPE # 2

Reference / Sample Number: 47

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.55 mm
Mean Distance between spots on Center row (d2): 2.86 mm
Mean distance between spots on slant vector (d1): 4.72 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.25**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**8.35**	8.429	**8.008**	**8.850**
d1 or hk1 (Camera K/slant vector dist.)	**5.06**	5.158	**4.900**	**5.416**
Ratio of hk0/hk1	**1.65**	1.63	**1.549**	**1.712**
Angle of Slant Vector (Measured)	76.0	76.8	**72.960**	**80.640**

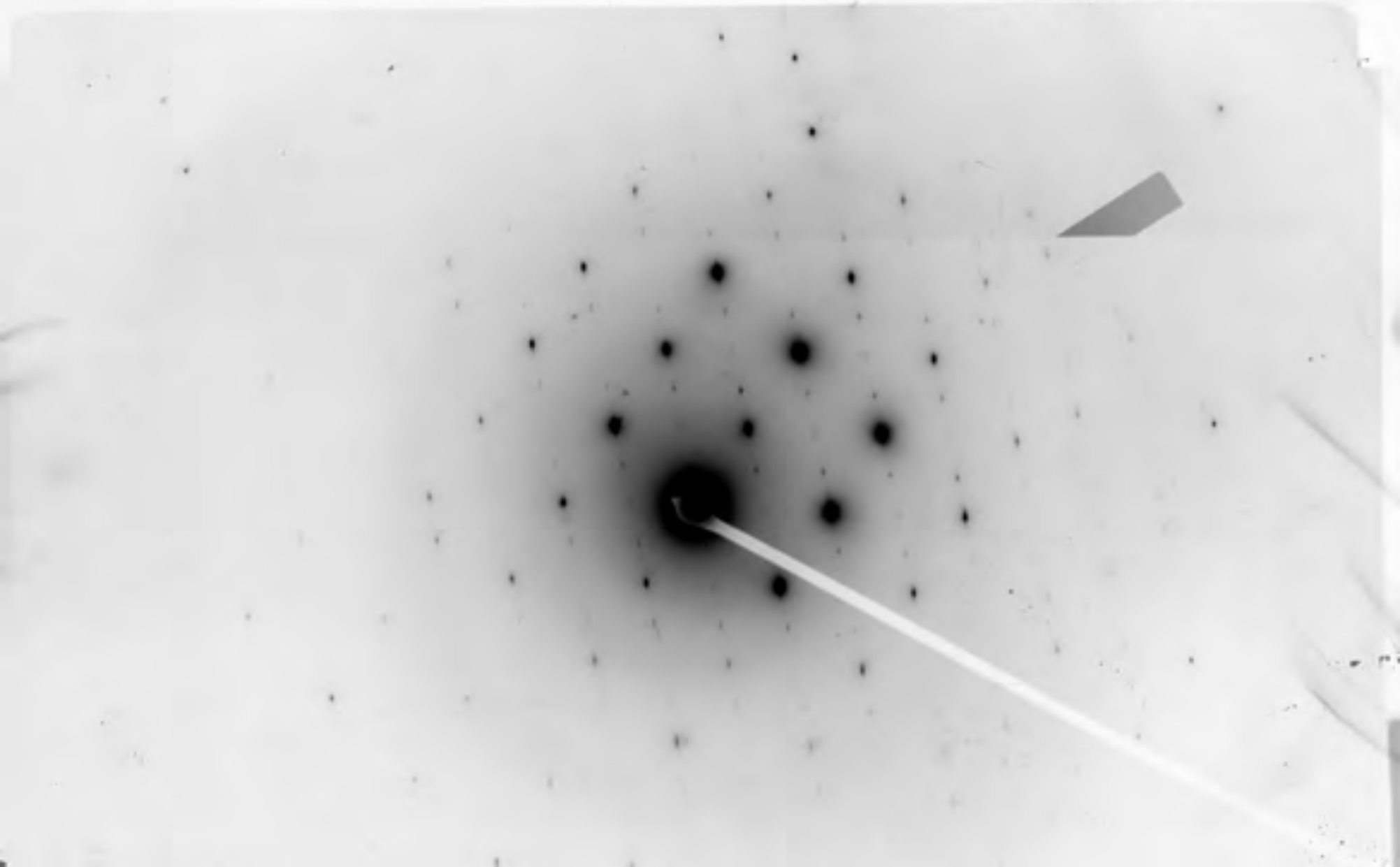
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [1 -1 0]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9843950



ISO 10312

TEM Asbestos Count Sheet

11/27/12 DYM

EMSL Sample ID:	0912111943-0048	Volume (L):	726	Scope:	09-02
Customer Sample:	HM-OP-HK-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	E, 4-6	Analysis Date:	10/8/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 DYM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
E4	F3	B	1	1	16.1	2.6	CD	CHRYS			
E4	F3	B	2	2	7.6	1.25	CD	CHRYS			
E4	F5	ND									
E4	F7	ND									
E4	F9	B	3	3	6.05	1.1	CD	CHRYS		43951	
E5	F7	B	4	4	51.2	8.2	CD	CHRYS			YES
E5	F5	ND									
E5	F3	ND									
E5	F1	ND									
E6	E10	ND									
E6	E8	B	5	5	12.9	3.5	CD	CHRYS			
E6	E6	ND									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

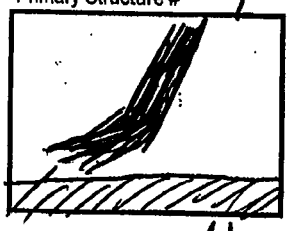
Structure Sketch Sheet

EMSL Order ID: 0912119413-0048 **Client:**

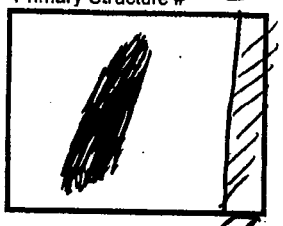
Client Sample:

Page 1 of 1

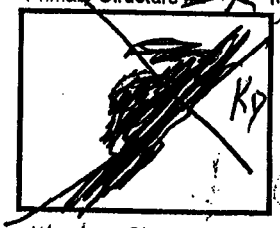
Primary Structure # 1



Primary Structure # 2

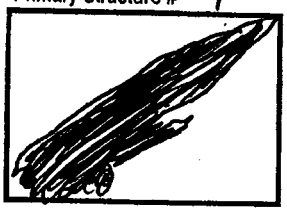


Primary Structure # ~~2~~ 11/27/12 DM

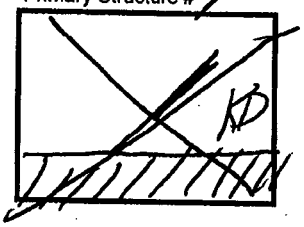


Primary Structure # 3

Primary Structure # 4

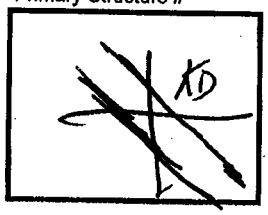


Primary Structure # 5

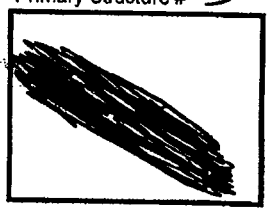


11/27/12 DM

Primary Structure #



Primary Structure # 5



Primary Structure #

Primary Structure #

Primary Structure #

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Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

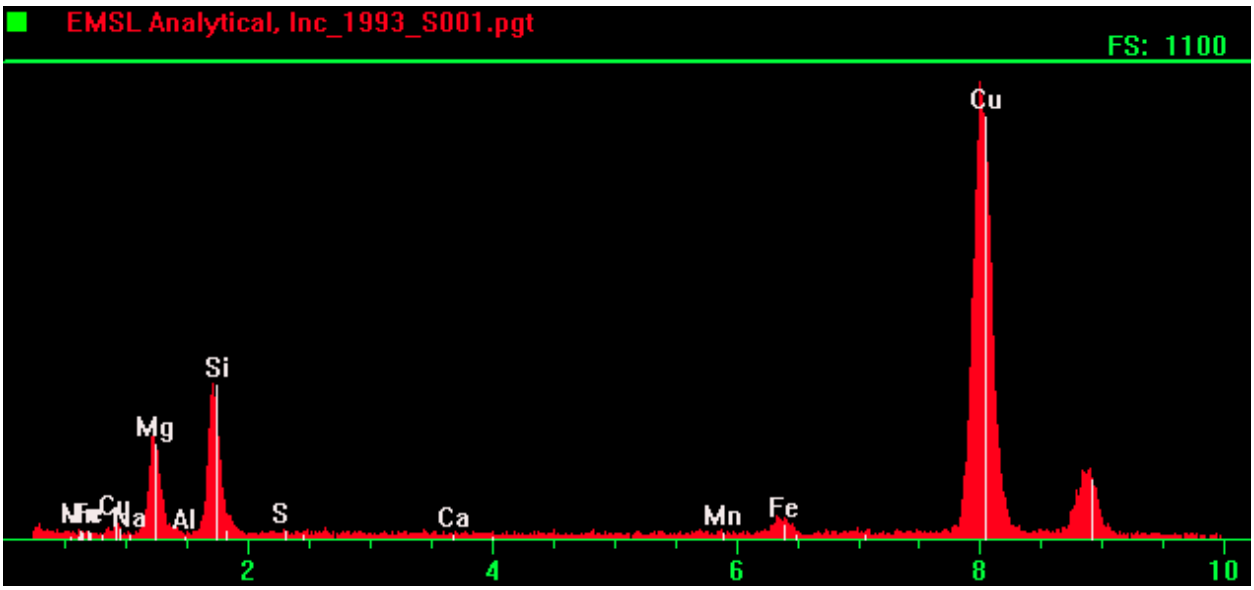
Analyst: KP Date: 8 OCT 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0048_TEM_ISO_10312_EDX_Chrysotile
Collected: October 08, 2012 14:28:56

Live Time:	32.08	Count Rate:	2568	Dead Time:	30.77 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	8.7	9.3	0.0	0.0
Mg	KA1	139.2	10.5	128.7	12.3
Al	KA1	11.9	10.3	1.6	0.2
Si	KA1	213.3	11.2	202.0	18.0
S	KA1	10.8	10.1	0.7	0.1
Ca	KA1	11.0	9.4	1.6	0.2
Mn	KA1	13.6	12.3	1.3	0.1
Fe	KA1	42.5	12.7	29.7	2.3
Cu	KA1	956.1	14.6	941.5	64.5

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43951 SCOPE #: 2

Reference / Sample Number: 48

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

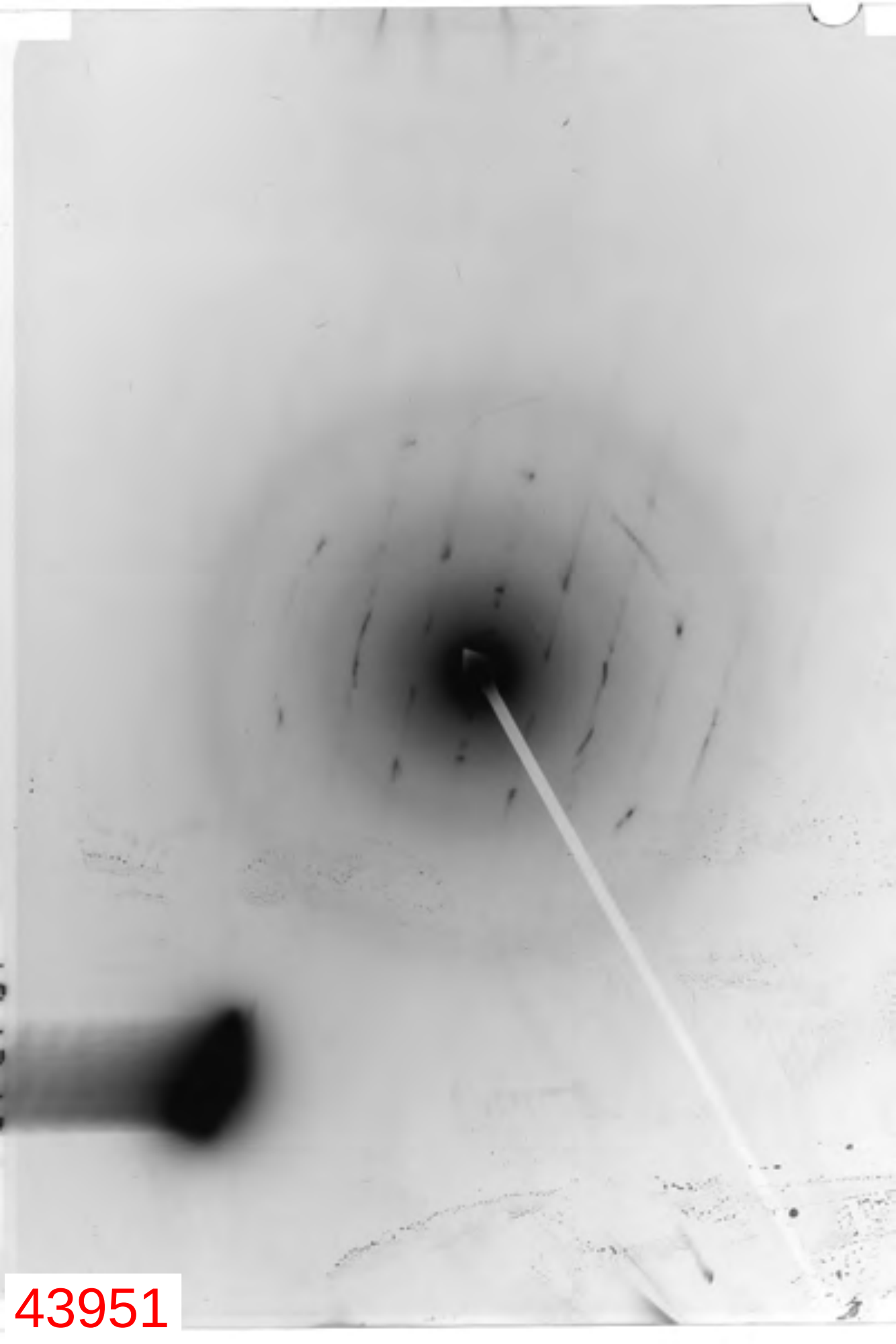
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	5.32	5.30	5.035	5.565
Angle to 110 reflection (Measured °)	61	60	57.000	63.000
d2 or d hk 0 (002) (Angstroms)	7.25	7.32	6.954	7.686
d1 or d hk 1 (110) (Angstroms)	4.74	4.58	4.351	4.809

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date:



43951

ISO 10312

TEM Asbestos Count Sheet

11/27/12 YVM

EMSL Sample ID:	091211~~1~~943-0049	Volume (L):	654	Scope:	09-02
Customer Sample:	HM-OP-HK-05	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	F, 1-3	Analysis Date:	10/8/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	12	none	3:1	5:1	
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Q~~ 11/27/12 YVM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F1	E8	B	1	1	6.1	1.6	CD	CHRYS			
F1	E8	B	2	2	15.5	3.4	CD	CHRYS		43999	YES
F1	E8	MD11	3		24	8.8	CD	CHRYS			
F1	E8	MB		3	20.1	3.8	CD	CHRYS			
F1	E8	B	4	4	5.8	1.6	ADX	ACTINOLITE		44000	YES
F1	E6	B	5	5	16.2	5.1	CD	CHRYS			
F1	E4	ND									
F1	E2	B	6	6	12.6	3	ADX	ACTINOLITE			
F2	A8	ND									
F2	A6	B	7	7	22.3	7.2	CD	CHRYS			

ISO 10312

091211943-0049

TEM Asbestos Count Sheet

F2	A4	B	8	8	20.05	3.4	CD	CHRYS			
F2	A4	B	9	9	29.2	3.2	CD	CHRYS			
F2	A2	B	10	10	10.4	1.8	ADX	ACTINOLITE			
F2	A2	B	11	11	6.4	0.3	CD	CHRYS			
F2	A2	B	12	12	10.8	2.05	CD	CHRYS			
F2	A2	B	13	13	8.6	0.3	CD	CHRYS			
F3	F8	MD11	14		35.5	15.6	CD	CHRYS			
F3	F8	MB		14	32.4	5.8	CD	CHRYS			
F3	F6	ND									
F3	F4	ND									
F3	F2	ND									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

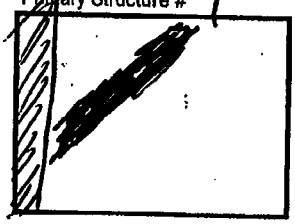
Structure Sketch Sheet

EMSL Order ID: 0912119430049 Client:

Client Sample:

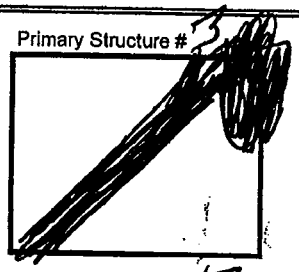
Page 1 of 1

Primary Structure # 1

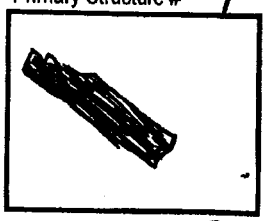


Primary Structure # 2

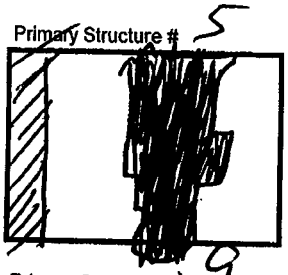
Primary Structure # 3



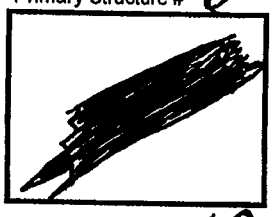
Primary Structure # 4



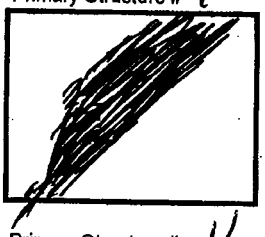
Primary Structure # 5



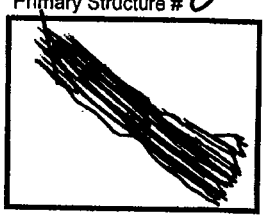
Primary Structure # 6



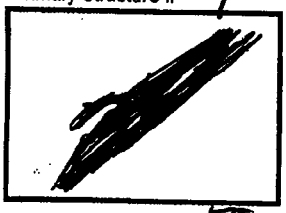
Primary Structure # 7



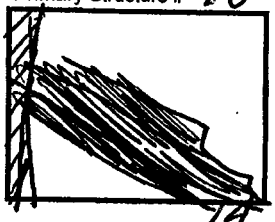
Primary Structure # 8



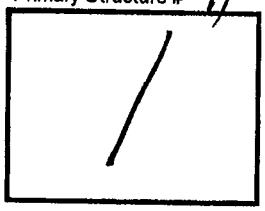
Primary Structure # 9



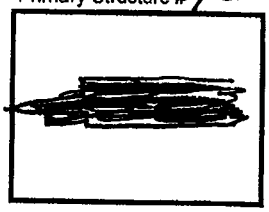
Primary Structure # 10



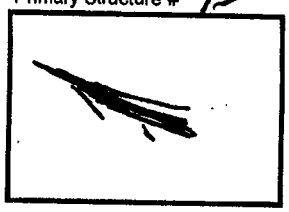
Primary Structure # 11



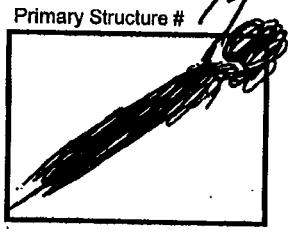
Primary Structure # 12



Primary Structure # 13



Primary Structure # 14



Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

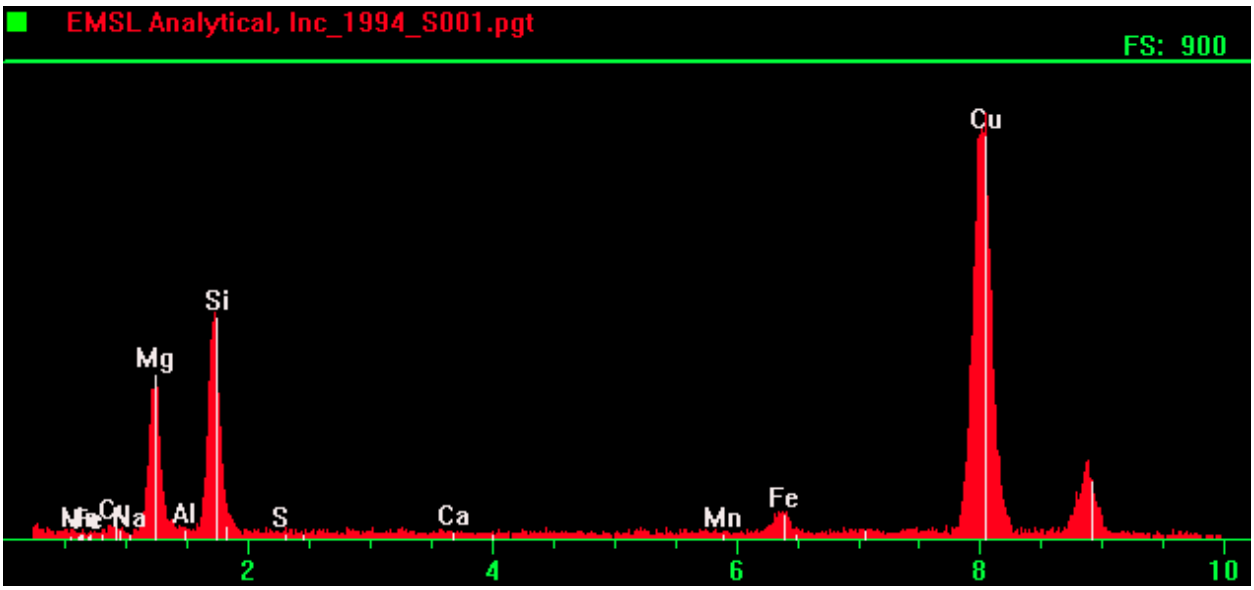
Analyst: KD Date: 8OCT12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0049_TEM_ISO_10312_EDX_Chrysotile
Collected: October 08, 2012 15:22:27

Live Time:	32.15	Count Rate:	2257	Dead Time:	27.06 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



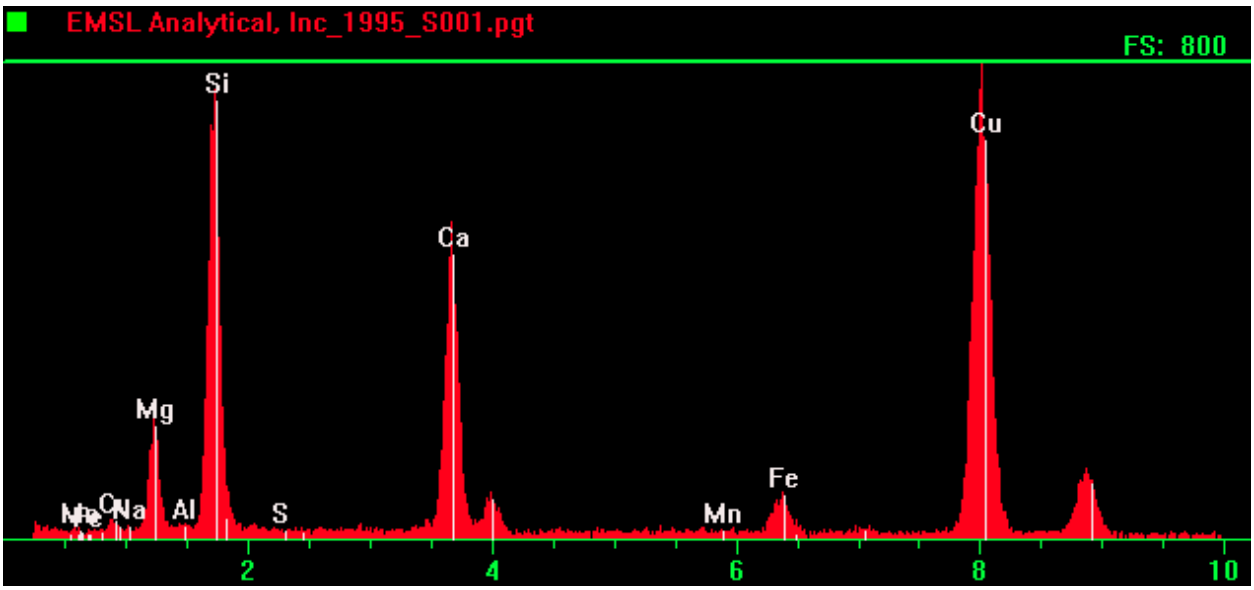
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	8.0	9.4	0.0	0.0
Mg	KA1	176.8	10.9	165.9	15.2
Al	KA1	14.9	11.2	3.7	0.3
Si	KA1	257.3	12.1	245.2	20.3
S	KA1	10.8	10.3	0.6	0.1
Ca	KA1	11.1	9.4	1.7	0.2
Mn	KA1	12.3	11.2	1.1	0.1
Fe	KA1	42.4	12.7	29.7	2.3
Cu	KA1	723.9	15.4	708.5	46.0

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0049_TEM_ISO_10312_EDX_Actinolite
Collected: October 08, 2012 15:31:41

Live Time:	74.01	Count Rate:	1219	Dead Time:	14.22 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	4.0	4.1	0.0	0.0
Mg	KA1	47.7	4.9	42.8	8.7
Al	KA1	6.7	5.2	1.4	0.3
Si	KA1	192.7	6.0	186.7	31.3
S	KA1	5.5	5.5	0.0	0.0
Ca	KA1	148.9	5.5	143.4	25.9
Mn	KA1	5.6	4.9	0.8	0.2
Fe	KA1	26.4	4.5	21.8	4.8
Cu	KA1	292.3	4.8	287.5	60.5

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 43999 SCOPE #: 2

Reference / Sample Number: 49

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.52 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

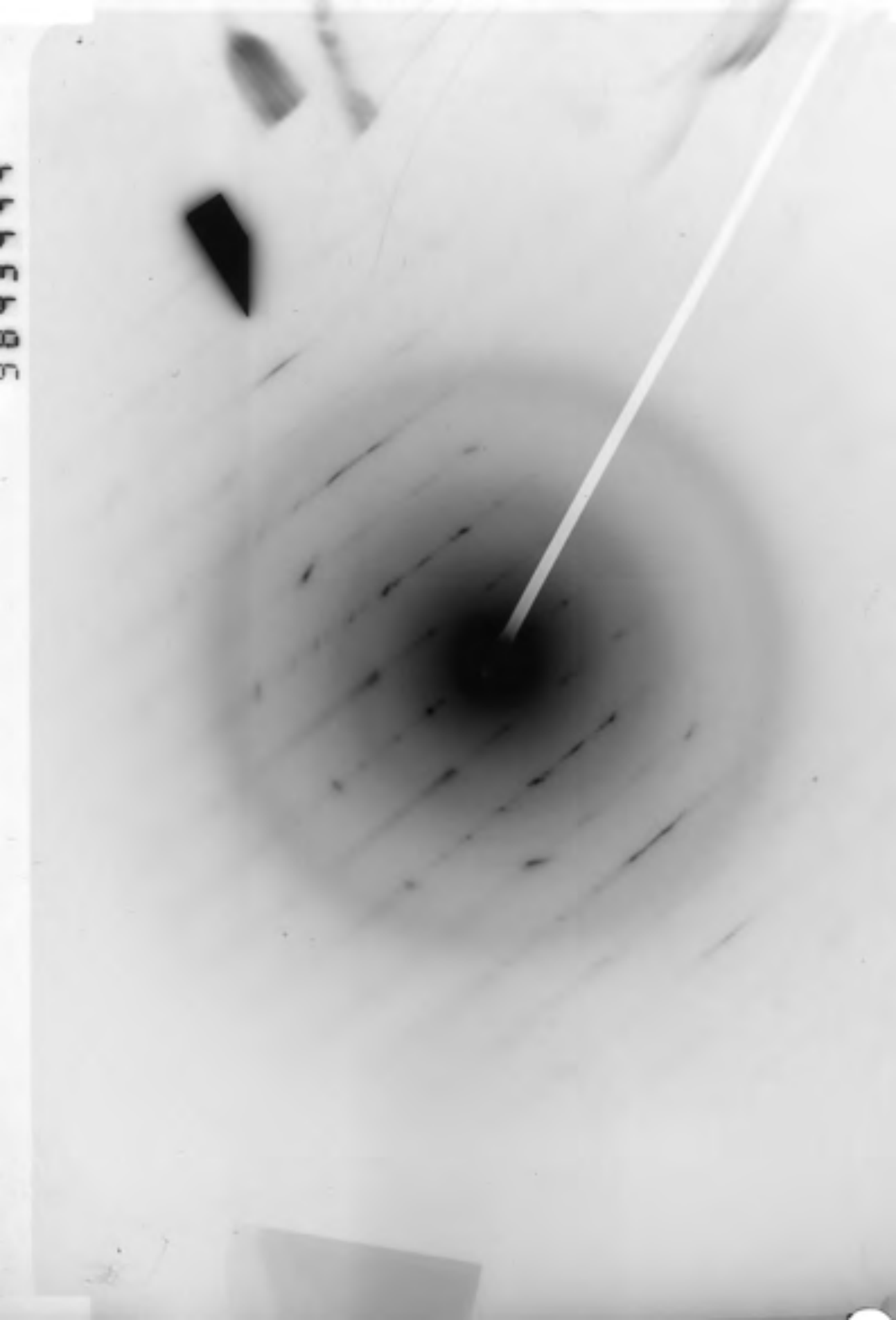
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.29**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	59	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 44000 SCOPE # 2

Reference / Sample Number: 49

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.495 mm
Mean Distance between spots on Center row (d2): 7.2 mm
Mean distance between spots on slant vector (d1): 4.75 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.31**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**3.32**	3.385	**3.216**	**3.554**
d1 or hk1 (Camera K/slant vector dist.)	**5.03**	4.931	**4.684**	**5.178**
Ratio of hk0/hk1	**0.66**	0.69	**0.656**	**0.725**
Angle of Slant Vector (Measured)	69.0	69.5	**66.025**	**72.975**

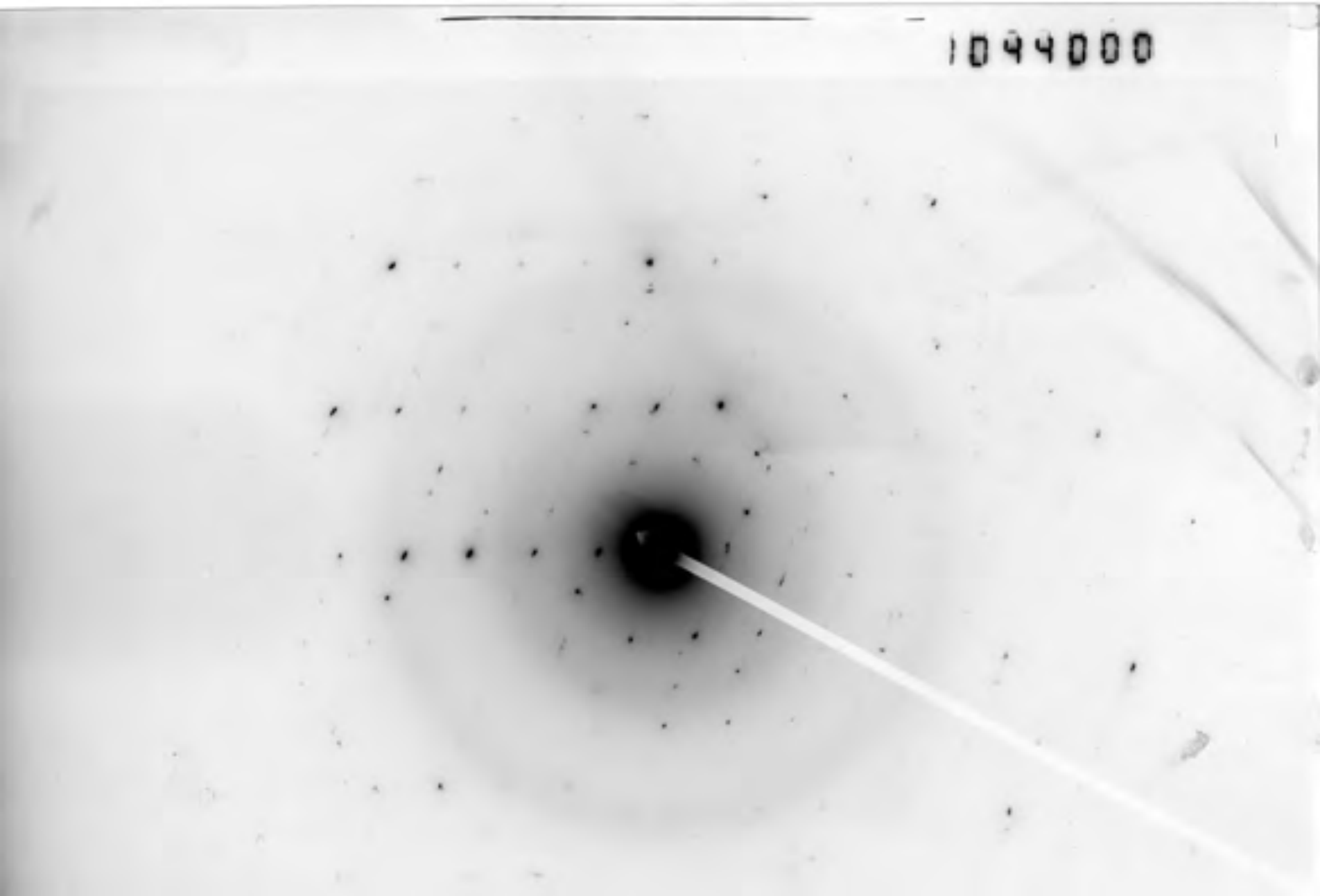
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [5 1 4]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

1044000



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0050 11/27/12 DM	Volume (L):	760	Scope:	09-02
Customer Sample:	HM-OP-~~18~~ RS-01 11/27/12 DM	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	F, 4-6	Analysis Date:	10/8/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	10	none	3:1	5:1	
GO Analyzed:	10				
Level of Analysis Chrysotile:	CDQ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
F4	E10	ND									
F4	E8	ND									
F4	E6	ND									
F4	E4	ND									
F5	E10	ND									
F5	E8	ND									
F5	E6	B	1	1	50.6	9.4	CDQ	CHRYS		43956	YES
F5	E4	ND									
F6	E7	B	2	2	7.5	2.1	CD	CHRYS			
F6	E5	B	3	3	10.5	1.1	CD	CHRYS			

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312

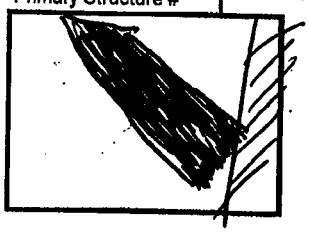
Structure Sketch Sheet

EMSL Order ID: 0912119-3-0050 **Client:**

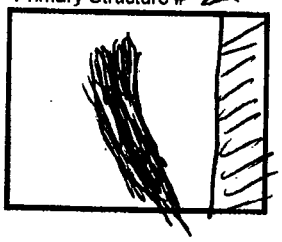
Client Sample:

Page 1 of 1

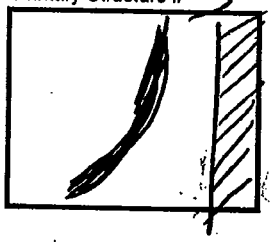
Primary Structure # 1



Primary Structure # 2



Primary Structure # 3



Primary Structure #

Primary Structure #

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Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

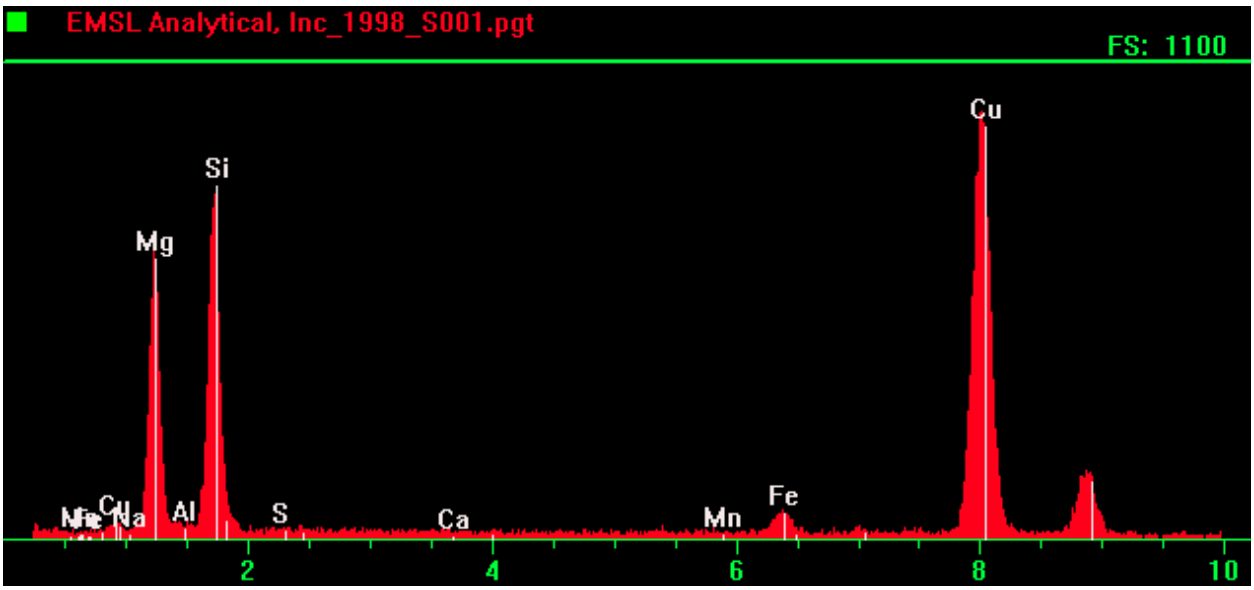
Analyst: KD Date: 8 OCT 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0050_TEM_ISO_10312_EDX_Chrysotile
Collected: October 08, 2012 17:38:31

Live Time:	69.14	Count Rate:	1482	Dead Time:	17.54 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	6.1	6.3	0.0	0.0
Mg	KA1	164.5	7.9	156.6	19.9
Al	KA1	11.2	8.0	3.2	0.4
Si	KA1	217.6	8.9	208.7	23.5
S	KA1	7.8	7.4	0.4	0.1
Ca	KA1	6.7	6.5	0.2	0.0
Mn	KA1	7.2	6.8	0.4	0.1
Fe	KA1	27.1	7.0	20.1	2.9
Cu	KA1	410.2	7.3	402.9	54.9

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43956 SCOPE #: 2

Reference / Sample Number: 50

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

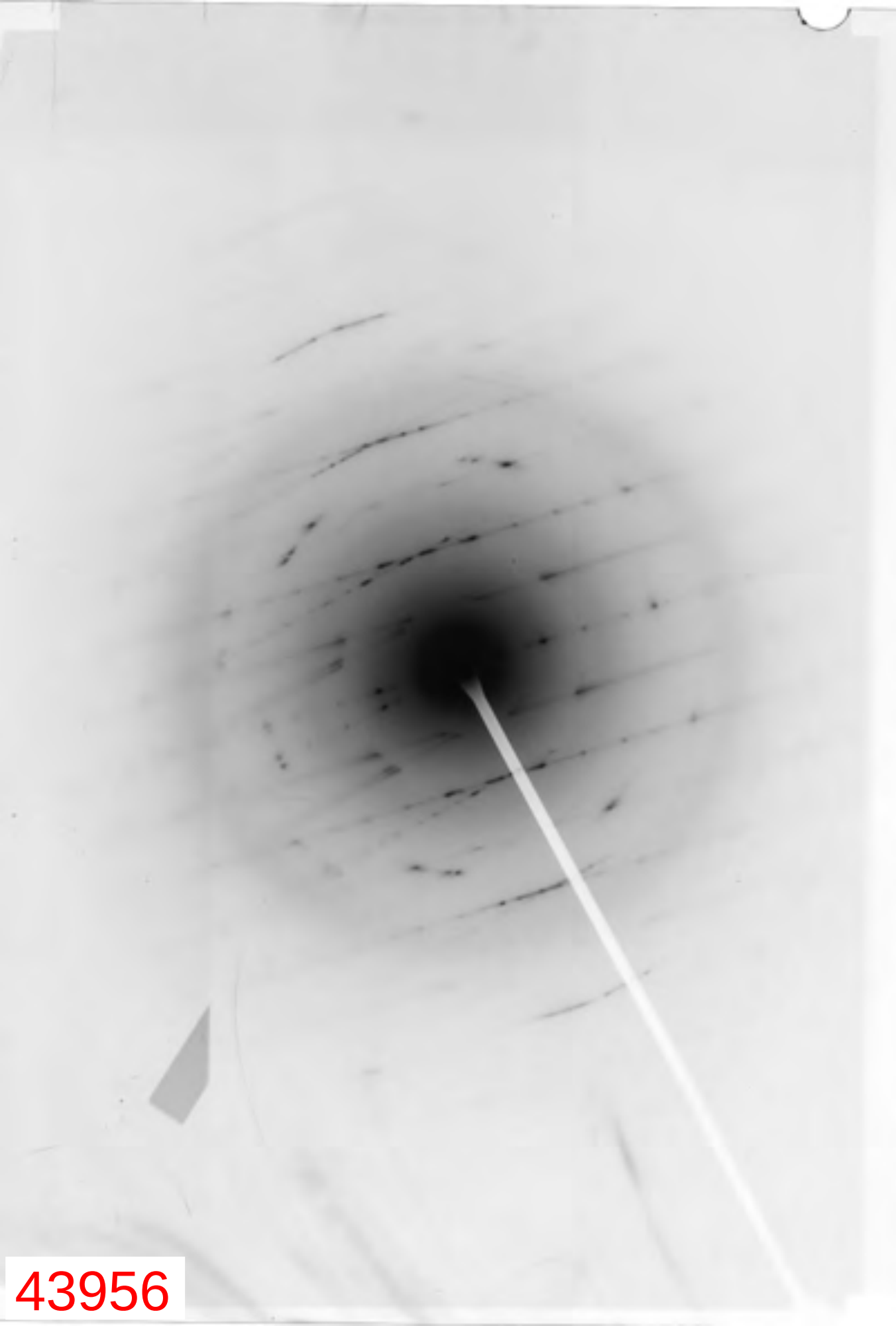
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	59	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43956

ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	091211~~1~~943-0051	Volume (L):	737	Scope:	09-0 2
Customer Sample:	HM-OP-RS-O2	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	G, 1-3	Analysis Date:	10/8/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~	11/27/12 DM	Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
G1	D1	ND									
G1	D3	ND									
G1	D5	B	1	1	7.6	1.15	CDQ	CHRYS		43957	YES
G1	D9	B	2	2	14.5	0.95	CD	CHRYS			
G1	D9	B	3	3	10	1.6	CD	CHRYS			
G2	C1	B	4	4	5.2	0.4	CD	CHRYS			
G2	C3	ND									
G2	C5	ND									
G2	C7	B	5	5	12.05	1.6	CD	CHRYS			
G2	C7	B	6	6	94.2	3.8	CD	CHRYS			

ISO 10312

091211943-0051

TEM Asbestos Count Sheet

G2	C7	B	7	7	10.2	1.6	CD	CHRYS			
G2	C7	B	8	8	15.8	1.8	CD	CHRYS			
G2	C7	B	9	9	15.6	1.25	CD	CHRYS			
G3	G1	B	10	10	17	2.8	CD	CHRYS			
G3	G3	MD11	11		15.8	7.5	CD	CHRYS			
G3	G3	MB		11	9.4	0.95	CD	CHRYS			
G3	G3	B	12	12	7.2	0.55	CD	CHRYS			
G3	G5	B	13	13	7.1	1.55	CD	CHRYS			
G3	G5	B	14	14	12.95	0.55	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

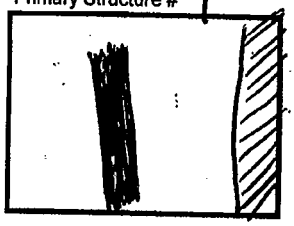
Structure Sketch Sheet

EMSL Order ID: 0912119413-0051 **Client:**

Client Sample:

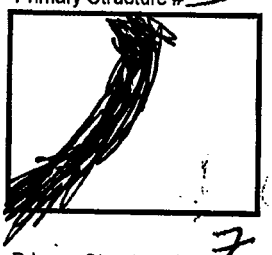
Page 1 of 1

Primary Structure # 1

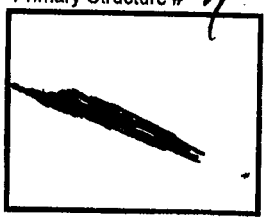


Primary Structure # 2

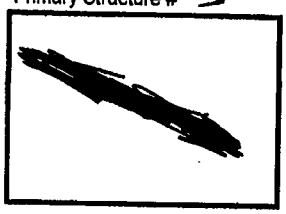
Primary Structure # 3



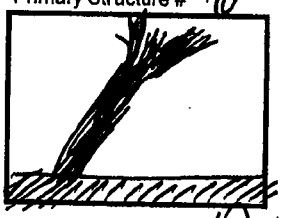
Primary Structure # 4



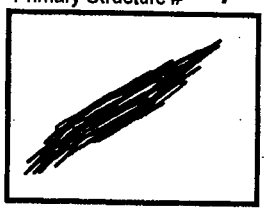
Primary Structure # 5



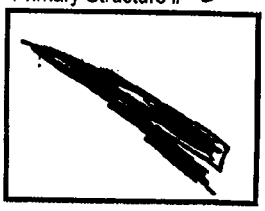
Primary Structure # 6



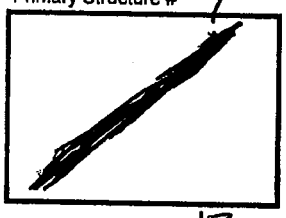
Primary Structure # 7



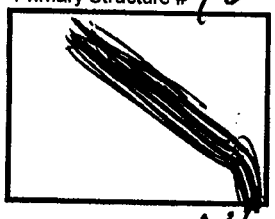
Primary Structure # 8



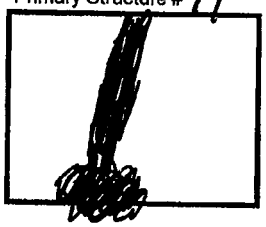
Primary Structure # 9



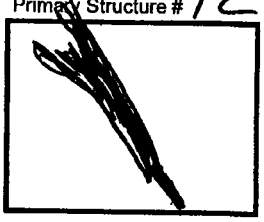
Primary Structure # 10



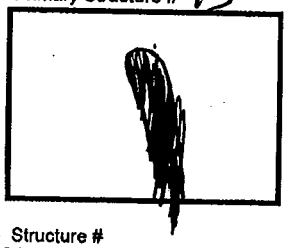
Primary Structure # 11



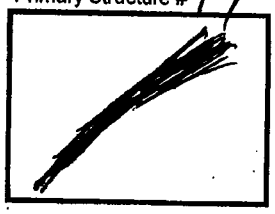
Primary Structure # 12



Primary Structure # 13



Primary Structure # 14



Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

Analyst: KD

Date: 8OCT12

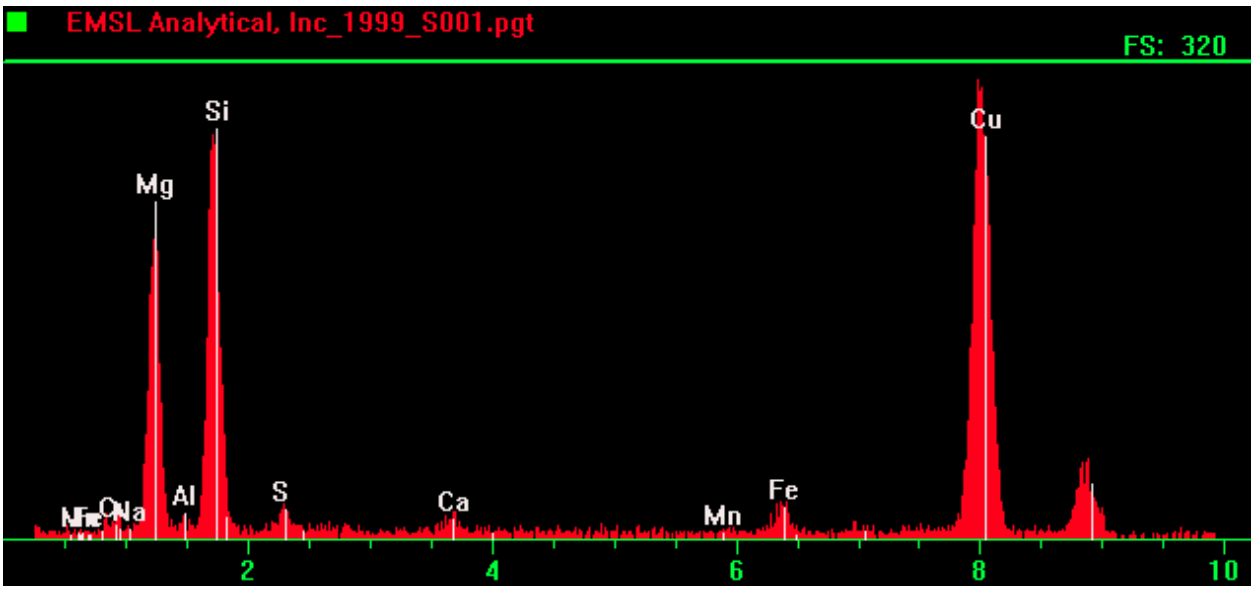
Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0051_TEM_ISO_10312_EDX_Chrysotile
Collected: October 08, 2012 18:34:45

Live Time:	44.10	Count Rate:	761	Dead Time:	9.17 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.4	3.9	0.0	0.0
Mg	KA1	90.8	4.4	86.4	19.9
Al	KA1	5.8	5.0	0.9	0.2
Si	KA1	123.5	4.8	118.7	24.7
S	KA1	9.2	3.7	5.5	1.5
Ca	KA1	9.2	2.7	6.4	2.4
Mn	KA1	3.3	2.4	0.9	0.4
Fe	KA1	13.2	2.8	10.3	3.7
Cu	KA1	202.8	3.5	199.2	56.3

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43957 SCOPE #: 2

Reference / Sample Number: 51

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.43 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

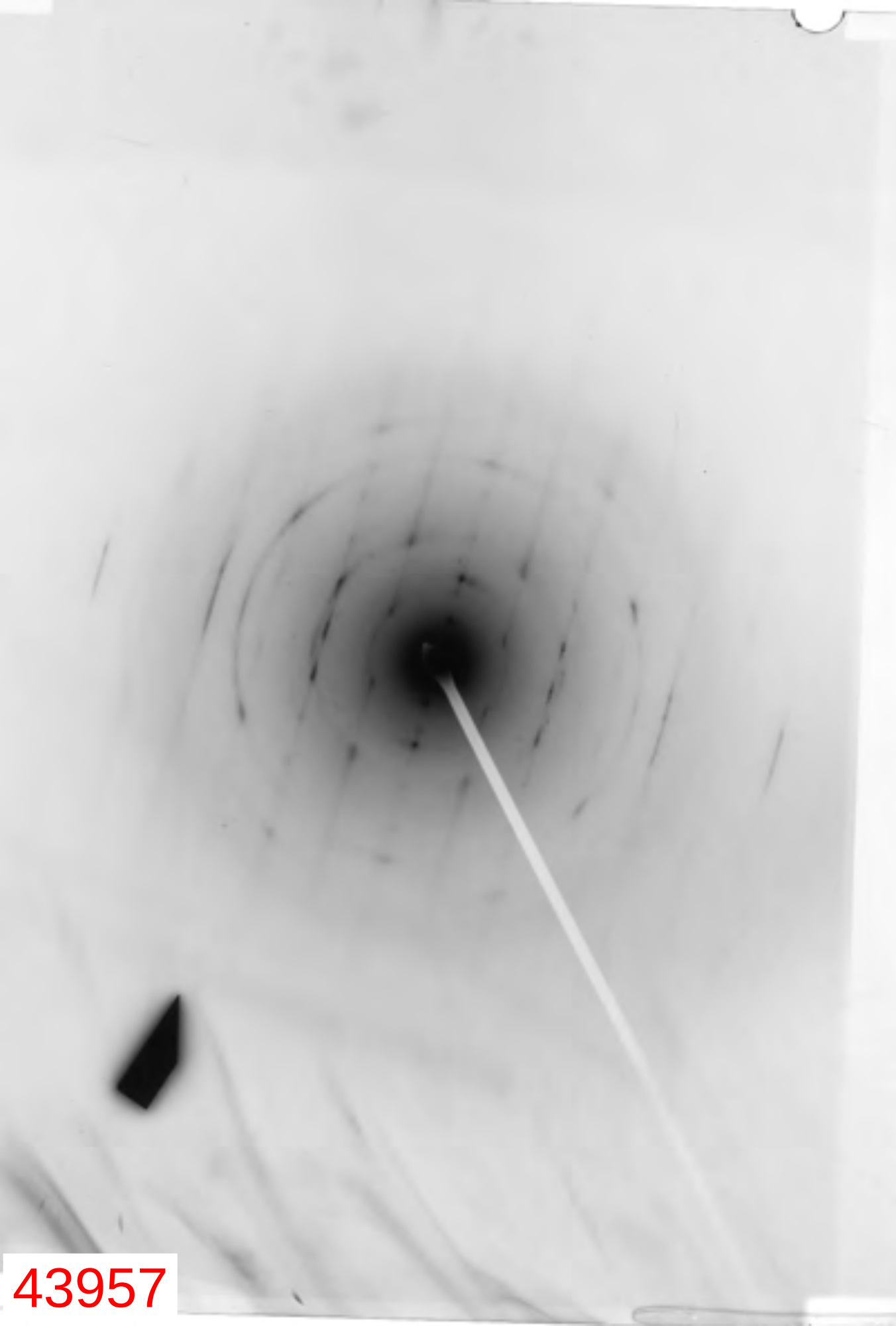
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.40**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	59	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43957

ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	0912111943-0052	Volume (L):	735	Scope:	09-02
Customer Sample:	HM-OP-RS-03	Prepped By:	PK	19-Sep GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	G, 4-6	Analysis Date:	10/9/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
G4	F1	B	1	1	15.8	2.6	ADX	ACTINOLITE		44001	YES
G4	F3	B	2	2	5.9	1.05	CD	CHRYS		43960	YES
G4	F5	ND									
G4	F7	ND									
G5	E10	B	3	3	26.6	3.5	CD	CHRYS			
G5	E10	B	4	4	19.6	4.2	CD	CHRYS			
G5	E10	B	5	5	7.5	0.8	CD	CHRYS			
G5	E10	B	6	6	15.6	2.15	CD	CHRYS			
G5	E8	B	7	7	23.2	5	CD	CHRYS			
G5	E8	B	8	8	11.2	2.3	ADX	ACTINOLITE			

ISO 10312

091211943-0052

TEM Asbestos Count Sheet

G5	E6	B	9	9	10.9	1.8	CD	CHRYS			
G5	E6	B	10	10	5.6	1.6	CD	CHRYS			
G5	E6	B	11	11	17.8	4.4	CD	CHRYS			
G5	E6	B	12	12	16.8	0.6	CD	CHRYS			
G5	E4	B	13	13	25.1	1.15	CD	CHRYS			
G5	E4	B	14	14	24.4	6.5	CD	CHRYS			
G5	E4	B	15	15	7.8	0.6	CD	CHRYS			
G6	F1	B	16	16	8.6	1	CD	CHRYS			
G6	F4	ND									
G6	F6	B	17	17	16.1	0.8	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

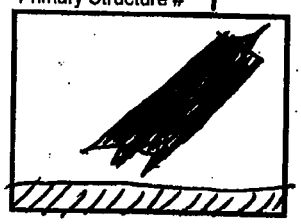
Structure Sketch Sheet

EMSL Order ID: 09121943-0052 **Client:**

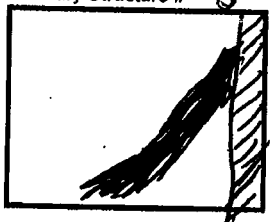
Client Sample:

Page 1 of 1

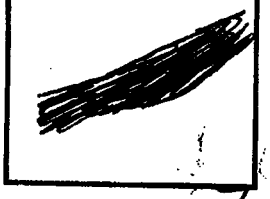
Primary Structure # 1



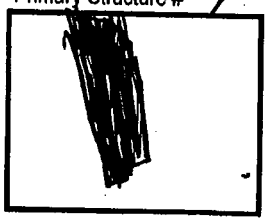
Primary Structure # 2



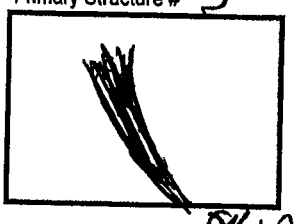
Primary Structure # 3



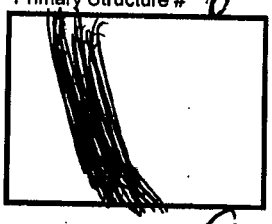
Primary Structure # 4



Primary Structure # 5



Primary Structure # 6



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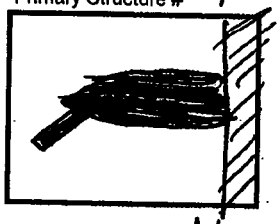
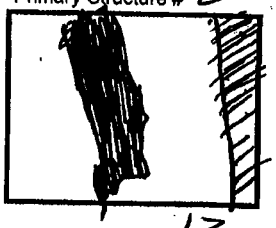
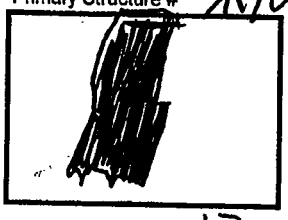


Primary Structure # 8



Primary Structure # 8/10



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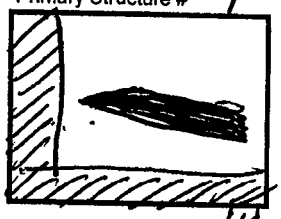

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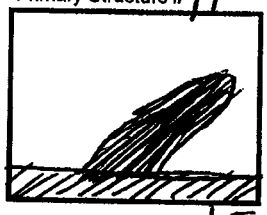
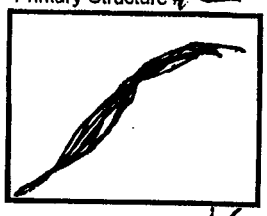


Primary Structure # 12



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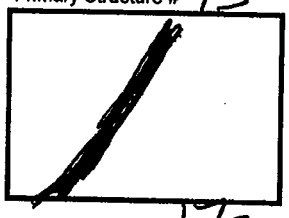
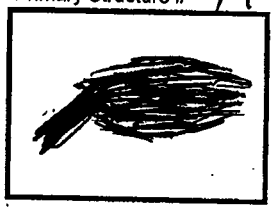


Primary Structure # 14



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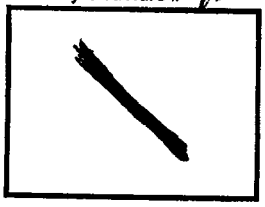
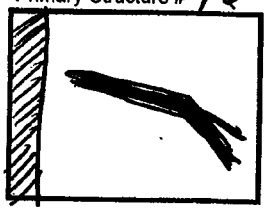
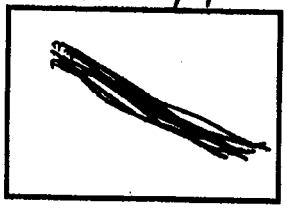


Primary Structure # 16



Structure # 17



Structure #

Structure #

Structure #

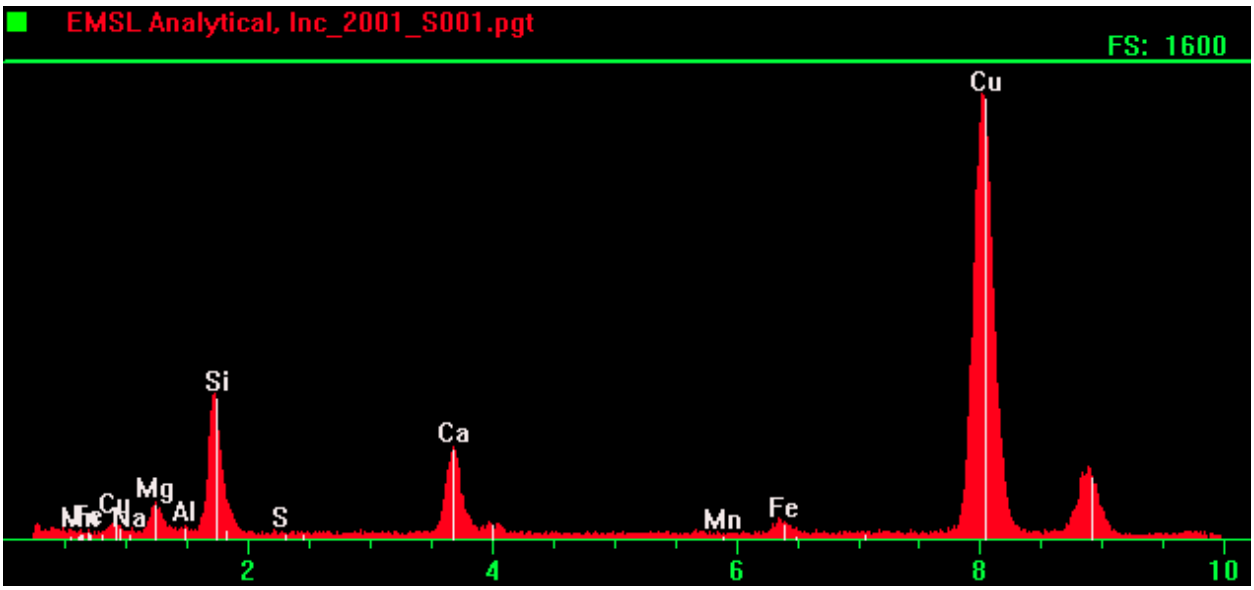
Analyst: KD Date: 9 OCT 12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0052_TEM_ISO_10312_EDX_Actinolite
Collected: October 08, 2012 19:33:06

Live Time:	34.01	Count Rate:	3818	Dead Time:	42.92 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



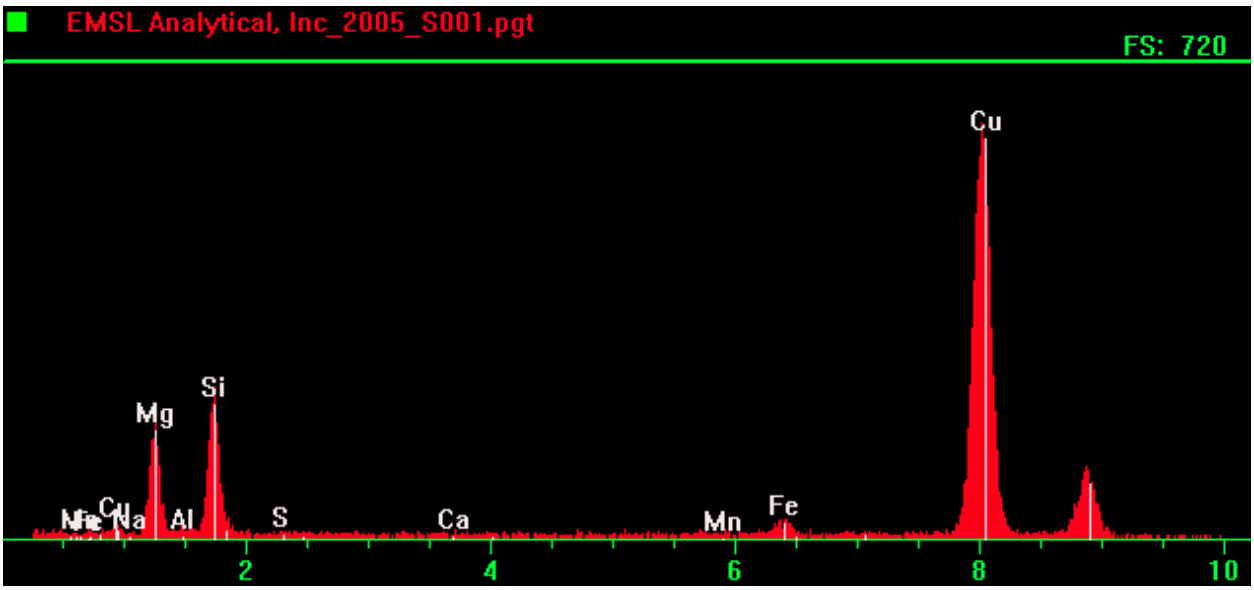
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	16.6	14.1	0.1	0.0
Mg	KA1	68.9	16.2	52.7	3.3
Al	KA1	21.8	15.5	6.3	0.4
Si	KA1	278.8	16.4	262.4	16.0
S	KA1	14.1	13.6	0.6	0.0
Ca	KA1	215.5	15.0	200.5	13.4
Mn	KA1	17.3	16.9	0.4	0.0
Fe	KA1	50.8	17.4	33.3	1.9
Cu	KA1	1362.8	20.6	1342.1	65.0

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0052_TEM_ISO_10312_EDX_Chrysotile
Collected: October 09, 2012 11:19:48

Live Time:	38.39	Count Rate:	1190	Dead Time:	14.88 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	5.2	5.1	0.0	0.0
Mg	KA1	76.4	5.6	70.7	12.6
Al	KA1	7.6	5.9	1.7	0.3
Si	KA1	105.3	5.6	99.7	17.9
S	KA1	5.1	4.2	0.9	0.2
Ca	KA1	6.2	4.0	2.2	0.5
Mn	KA1	6.1	4.7	1.4	0.3
Fe	KA1	19.0	4.7	14.2	3.0
Cu	KA1	467.4	6.1	461.4	75.7

EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 44000 12/4/12 om SCOPE # 2

Reference / Sample Number: 52

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.51 mm
Mean Distance between spots on Center row (d2): 7.2 mm
Mean distance between spots on slant vector (d1): 5.5 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.30**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**3.32**	3.385	**3.216**	**3.554**
d1 or hk1 (Camera K/slant vector dist.)	**4.34**	4.482	**4.258**	**4.706**
Ratio of hk0/hk1	**0.76**	76.00	**72.200**	**79.800**
Angle of Slant Vector (Measured)	66.0	67.5	**64.125**	**70.875**

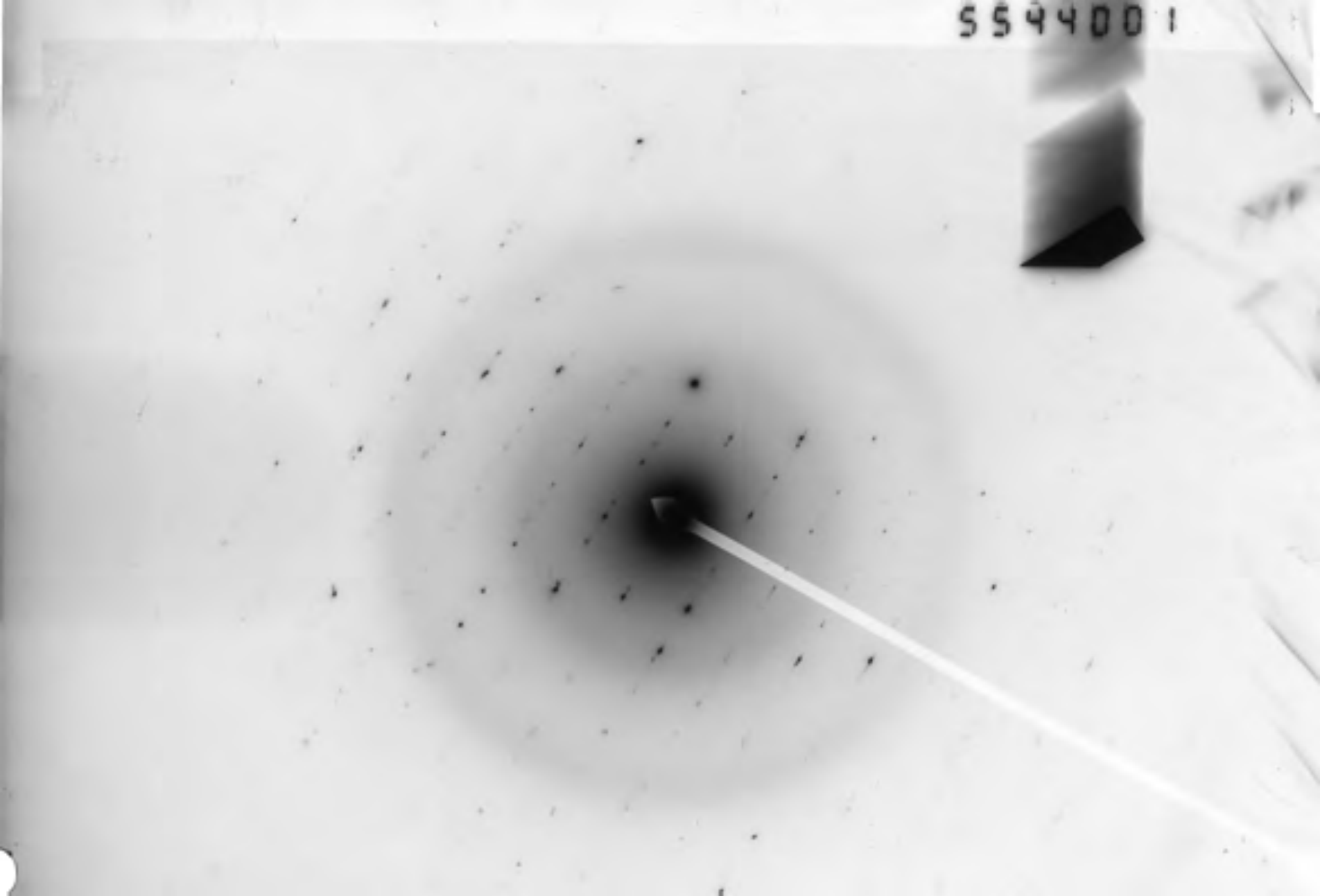
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [5 1 -2]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

S544001



EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43960 SCOPE #: 2

Reference / Sample Number: 52

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.6 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.25	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.20**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.56**	**4.58**	**4.351**	**4.809**

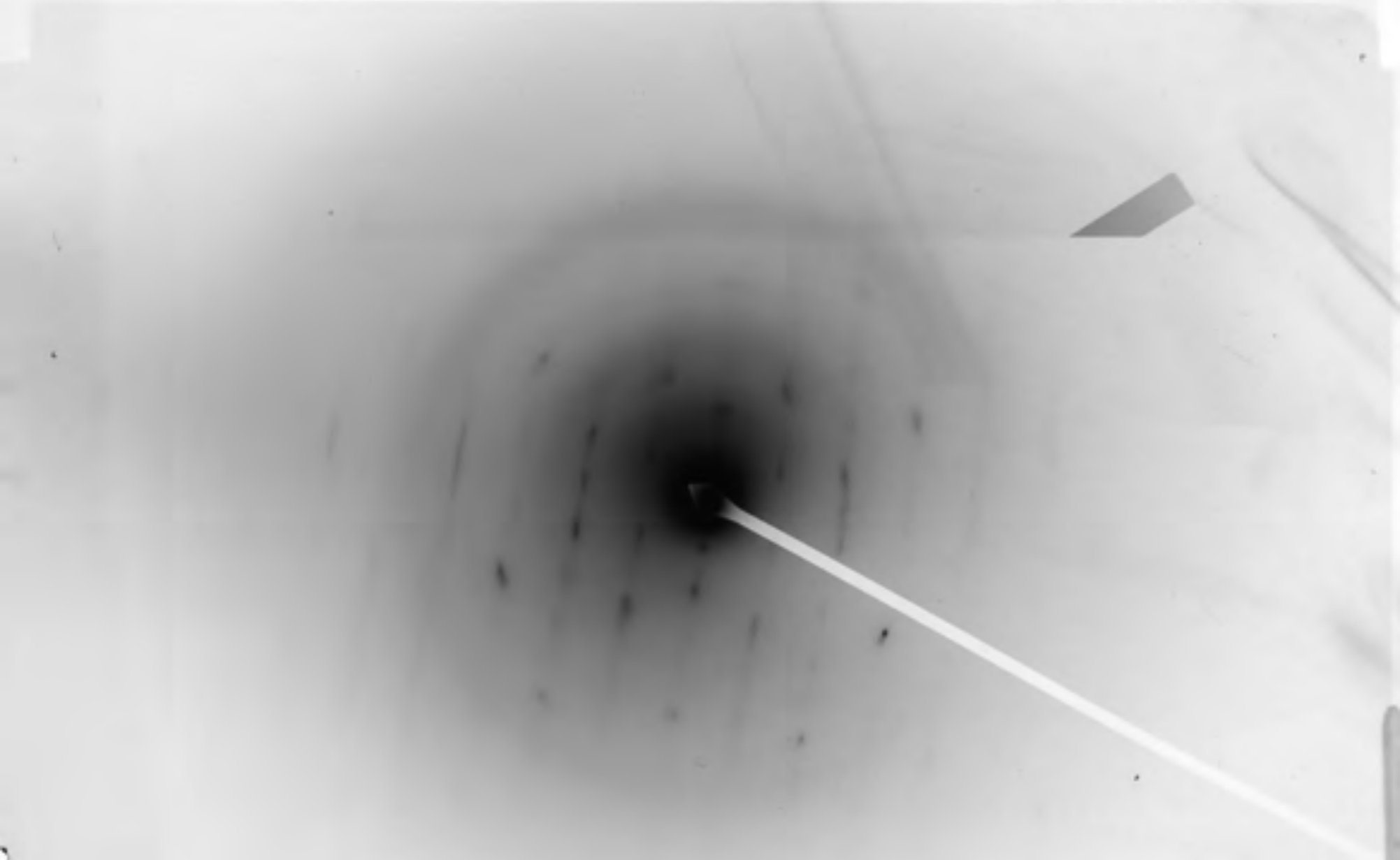
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9843960



ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	0912111943-0053	Volume (L):	797	Scope:	09-02
Customer Sample:	HM-OP-RS-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	H, 1-3	Analysis Date:	10/9/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	10	none	3:1	5:1	
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
H1	F4	ND									
H1	F6	B	1	1	10	2.6	CD	CHRYS			
H1	F6	MD11	2		17.2	13.3	ADX	ACTINOLITE		43963	YES
H1	F6	MB		2	9.6	0.35	ADX	ACTINOLITE			
H1	F6	B	3	3	33.2	5.6	CD	CHRYS		43964	YES
H1	F6	B	4	4	7.1	1.6	CD	CHRYS			
H1	F6	MD11	5		15	2.8	CD	CHRYS			
H1	F6	MB		5	10.3	1.4	CD	CHRYS			
H1	F6	MD11	6		12.3	5.6	CD	CHRYS			
H1	F6	MB		6	12.3	2.6	CD	CHRYS			

ISO 10312

091211943-0053

TEM Asbestos Count Sheet

H1	F6	B	7	7	21.1	4.6	CD	CHRYS			
H1	F8	ND									
H1	F10	B	8	8	6.15	1.8	CD	CHRYS			
H1	F10	B	9	9	12.05	2.9	CD	CHRYS			
H2	F5	B	10	10	6.4	0.6	ADX	ACTINOLITE			
H2	F3	B	11	11	8.3	2.15	CD	CHRYS			
H2	F3	B	12	12	16.8	1.2	CD	CHRYS			
H2	F10	B	13	13	6.4	2.1	CD	CHRYS			
H2	F10	B	14	14	31.2	6.05	CD	CHRYS			
H3	E10	ND									
H3	E8	MD11	15		15	10.6	CD	CHRYS			
H3	E8	MB		15	10	2.3	CD	CHRYS			
H3	E6	MD11	16		23.8	10.3	CD	CHRYS			
H3	E6	MB		16	20.8	5	CD	CHRYS			
H3	E6	B	17	17	6.15	1.05	CD	CHRYS			
H3	E6	B	18	18	23.8	2.8	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

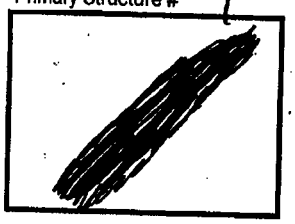
EMSL Order ID: 09121193-0053

Client:

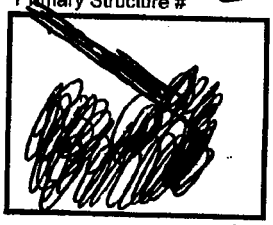
Client Sample:

Page 1 of 1

Primary Structure # 1



Primary Structure # 2



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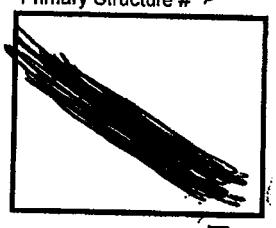

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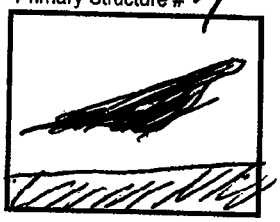

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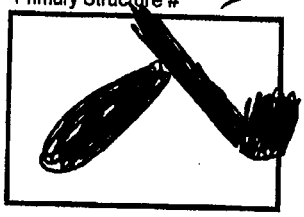
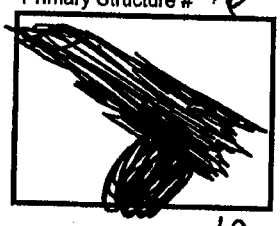


Primary Structure # 6



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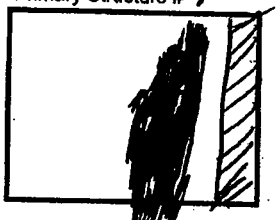
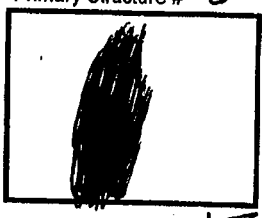
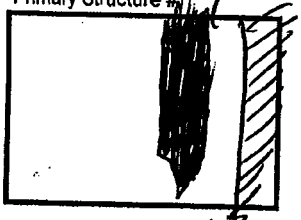


Primary Structure # 8



Primary Structure # 9



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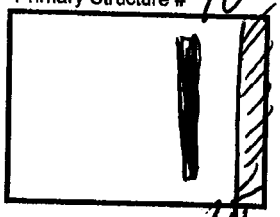

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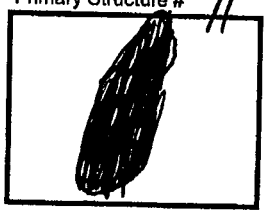

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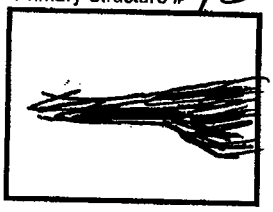
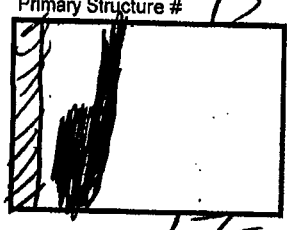
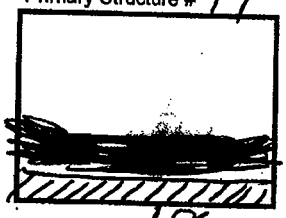


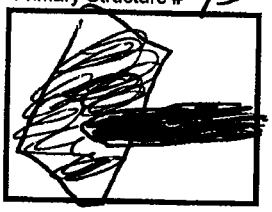
Primary Structure # 13



Primary Structure # 14

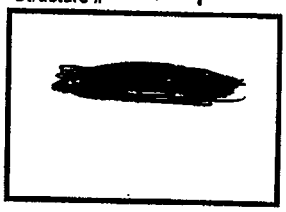


Primary Structure # 15

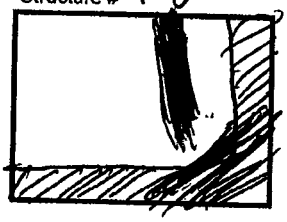


Primary Structure # 16

Structure # 17



Structure # 18



Structure #

Structure #

Analyst: KP

Date: 9OCT12

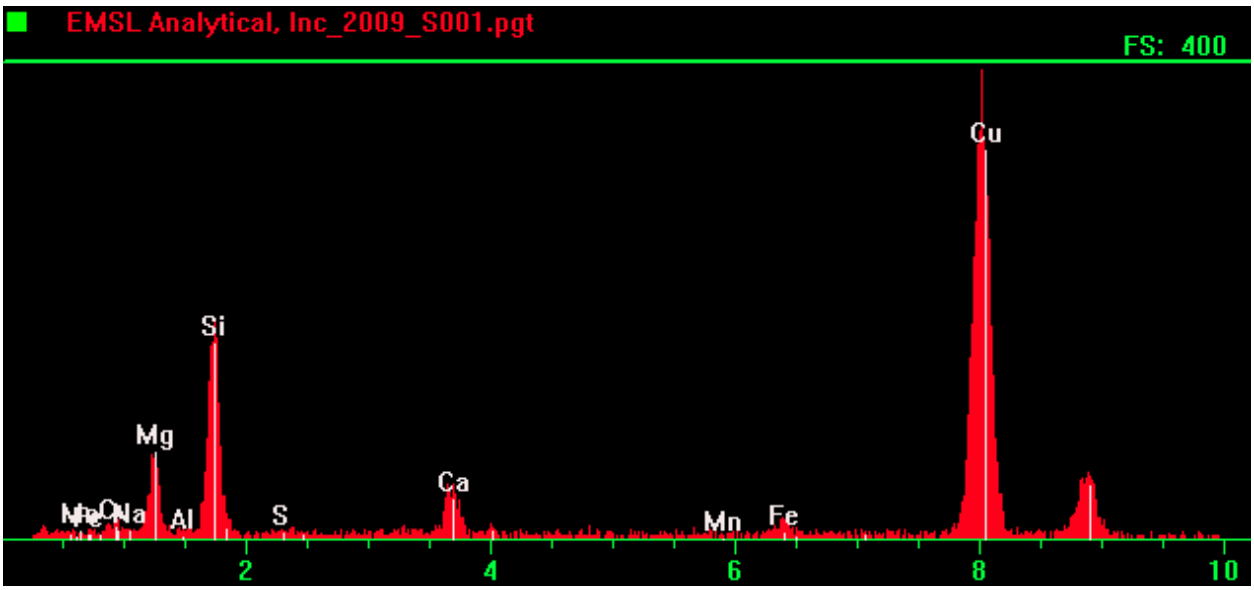
Scope: KZ

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0053_TEM_ISO_10312_EDX_Actinolite
Collected: October 09, 2012 13:01:28

Live Time:	66.50	Count Rate:	431	Dead Time:	5.86 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



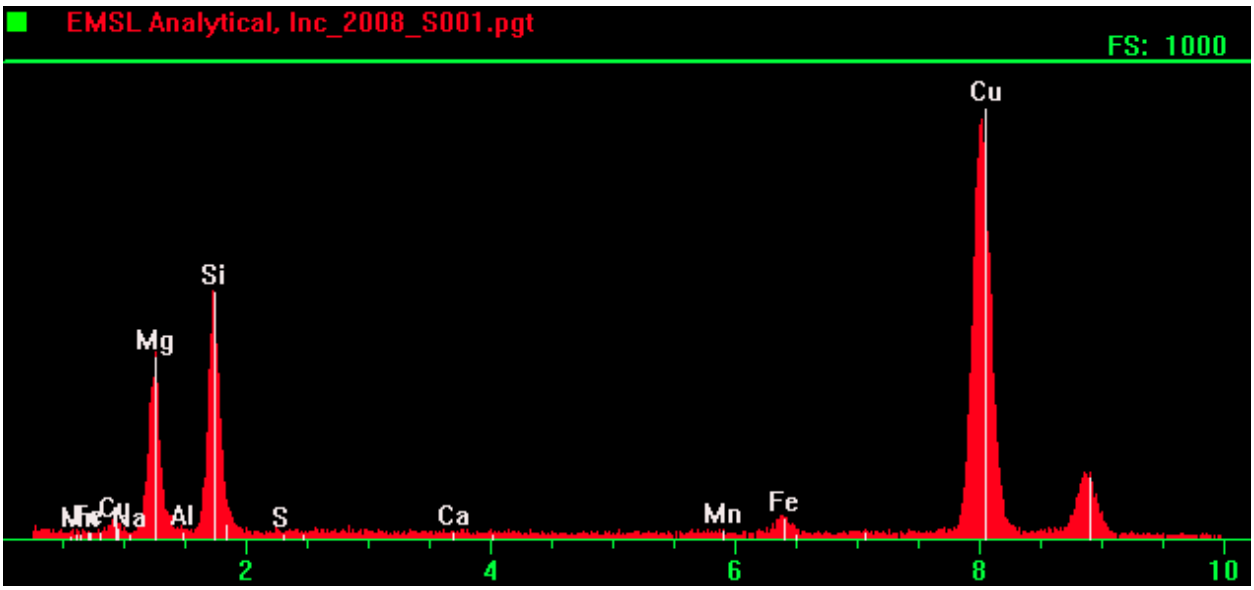
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	2.5	2.1	0.1	0.0
Mg	KA1	18.2	2.2	16.1	7.4
Al	KA1	2.3	2.3	0.0	0.0
Si	KA1	52.8	2.0	50.8	25.8
S	KA1	1.7	1.6	0.1	0.1
Ca	KA1	15.5	2.3	13.1	5.6
Mn	KA1	1.8	1.6	0.2	0.1
Fe	KA1	6.0	1.9	4.0	2.1
Cu	KA1	154.0	2.6	151.4	58.5

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0053_TEM_ISO_10312_EDX_Chrysotile
Collected: October 09, 2012 12:57:19

Live Time:	37.59	Count Rate:	2187	Dead Time:	25.95 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	10.3	11.3	0.0	0.0
Mg	KA1	185.0	12.6	172.4	13.6
Al	KA1	14.1	13.4	0.7	0.1
Si	KA1	258.1	13.0	245.1	18.9
S	KA1	10.3	10.1	0.0	0.0
Ca	KA1	10.6	9.9	0.7	0.1
Mn	KA1	12.6	9.6	3.0	0.3
Fe	KA1	34.1	10.4	23.5	2.3
Cu	KA1	702.2	14.1	688.1	48.8

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/15/12

Indexing of negative number: 43963 SCOPE # 2

Reference / Sample Number: 53

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.52 mm
Mean Distance between spots on Center row (d2): 5.15 mm
Mean distance between spots on slant vector (d1): 4.977 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.29**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**4.64**	4.762	**4.524**	**5.000**
d1 or hk1 (Camera K/slant vector dist.)	**4.80**	4.931	**4.684**	**5.178**
Ratio of hk0/hk1	**0.97**	97.00	**92.150**	**101.850**
Angle of Slant Vector (Measured)	76.0	74.3	**70.585**	**78.015**

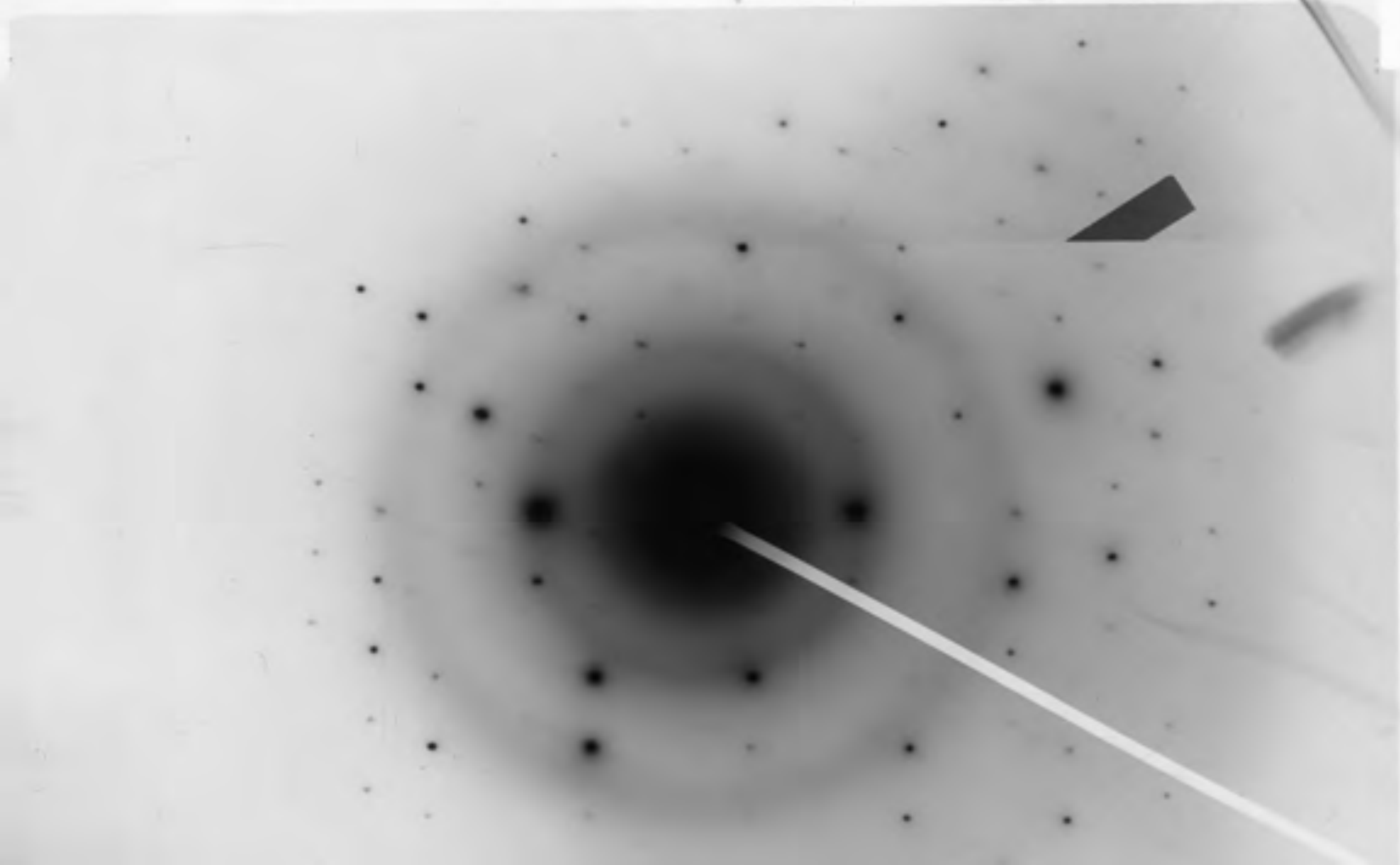
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [0 1 -1]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9843963



CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43964 SCOPE #: 2

Reference / Sample Number: 53

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.51 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.35	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.31**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.14**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

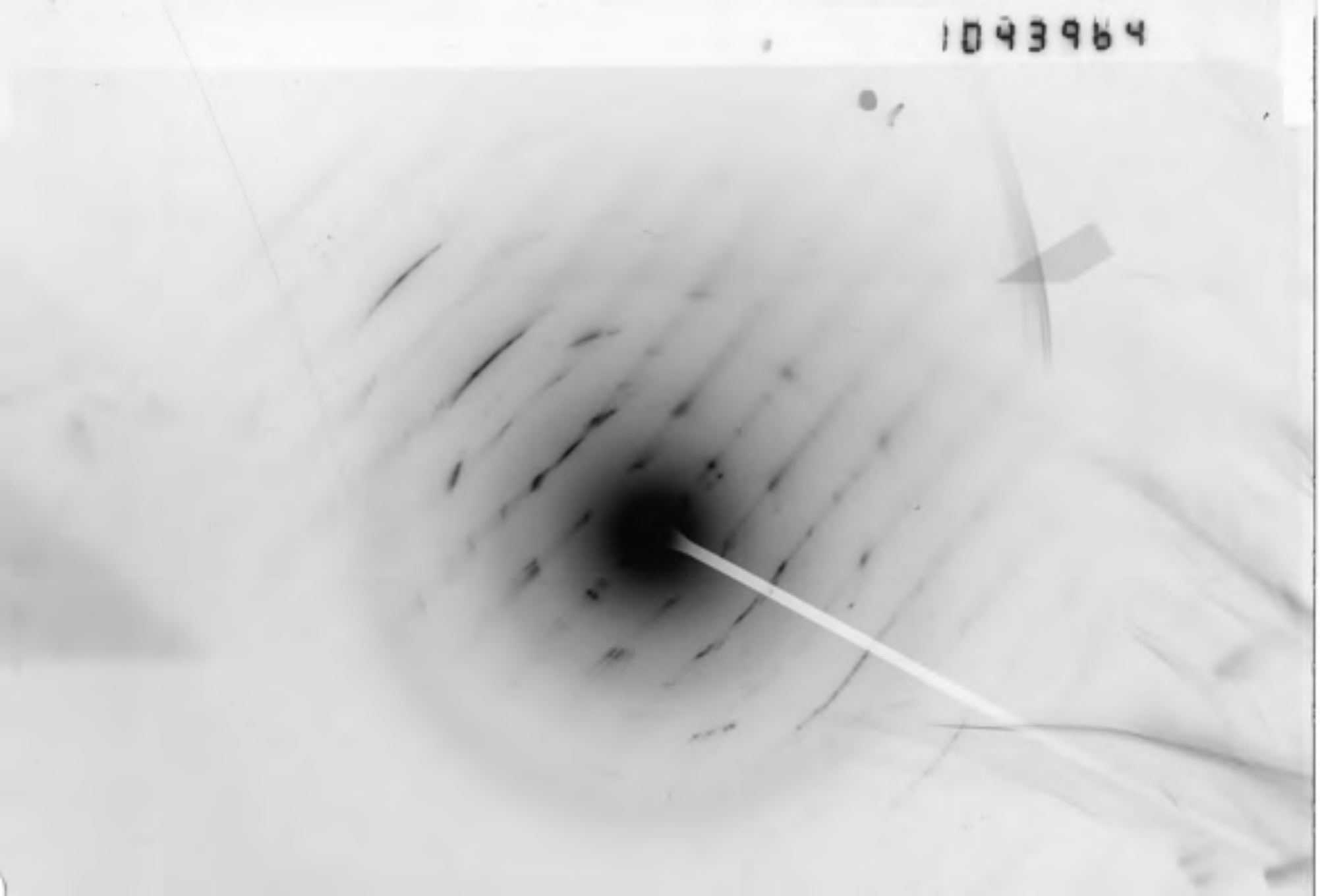
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

1043964



ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	091211~~7~~943-0054	Volume (L):	723	Scope:	09-02
Customer Sample:	HM-OP-RS-05	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	H, 4-6	Analysis Date:	10/9/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	~~CDQ~~	11/27/12 DM	Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
H4	C10	B	1	1	10.05	1.8	CD	CHRYS		43965	
H4	C10	B	2	2	16.2	2.8	CD	CHRYS			
H4	C8	ND									
H4	C6	ND									
H4	C4	ND									
H4	C2	B	3	3	6.8	0.8	CD	CHRYS			YES
H5	D1	ND									
H5	D3	ND									
H5	D5	ND									
H6	E10	ND									
H6	E8	ND									
H6	E6	B	4	4	10	1.6	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

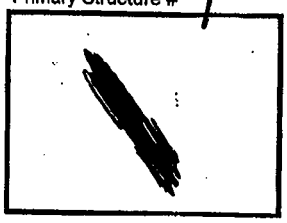
Structure Sketch Sheet

EMSL Order ID: 091211943-0054 **Client:**

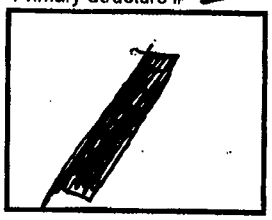
Client Sample:

Page 1 of 1

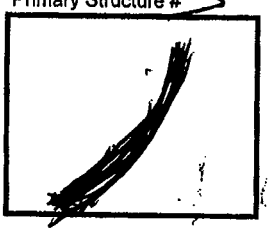
Primary Structure # 1



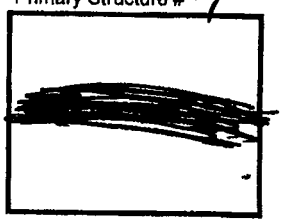
Primary Structure # 2



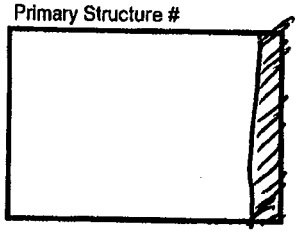
Primary Structure # 3



Primary Structure # 4



Primary Structure #



Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

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Primary Structure #

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Primary Structure #

Structure #

Structure #

Structure #

Structure #

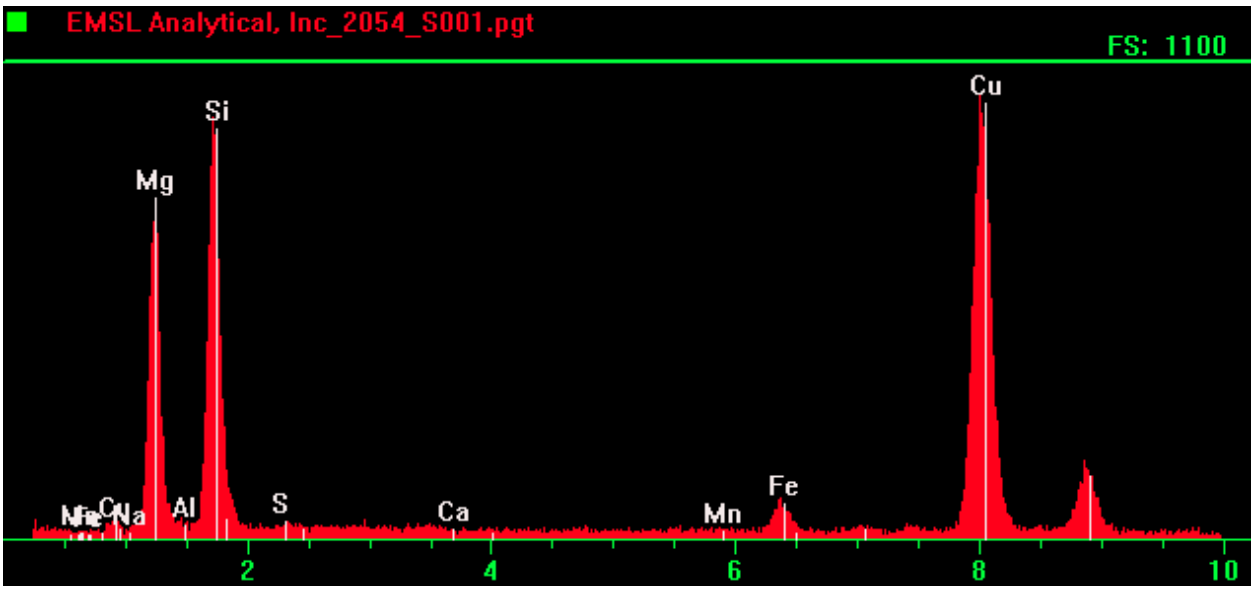
Analyst: KD Date: 90412 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0054_TEM_ISO_10312_EDX_Chrysotile
Collected: October 09, 2012 13:27:33

Live Time:	48.09	Count Rate:	2546	Dead Time:	28.22 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	11.3	9.1	0.8	0.1
Mg	KA1	283.8	10.2	273.6	26.9
Al	KA1	18.1	12.2	5.9	0.5
Si	KA1	390.6	13.5	377.1	27.9
S	KA1	15.7	14.0	1.7	0.1
Ca	KA1	13.8	12.6	1.2	0.1
Mn	KA1	14.8	12.0	2.9	0.2
Fe	KA1	52.9	13.1	39.6	3.0
Cu	KA1	618.1	15.4	602.7	39.1

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43965 SCOPE #: 2

Reference / Sample Number: 54

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.46 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

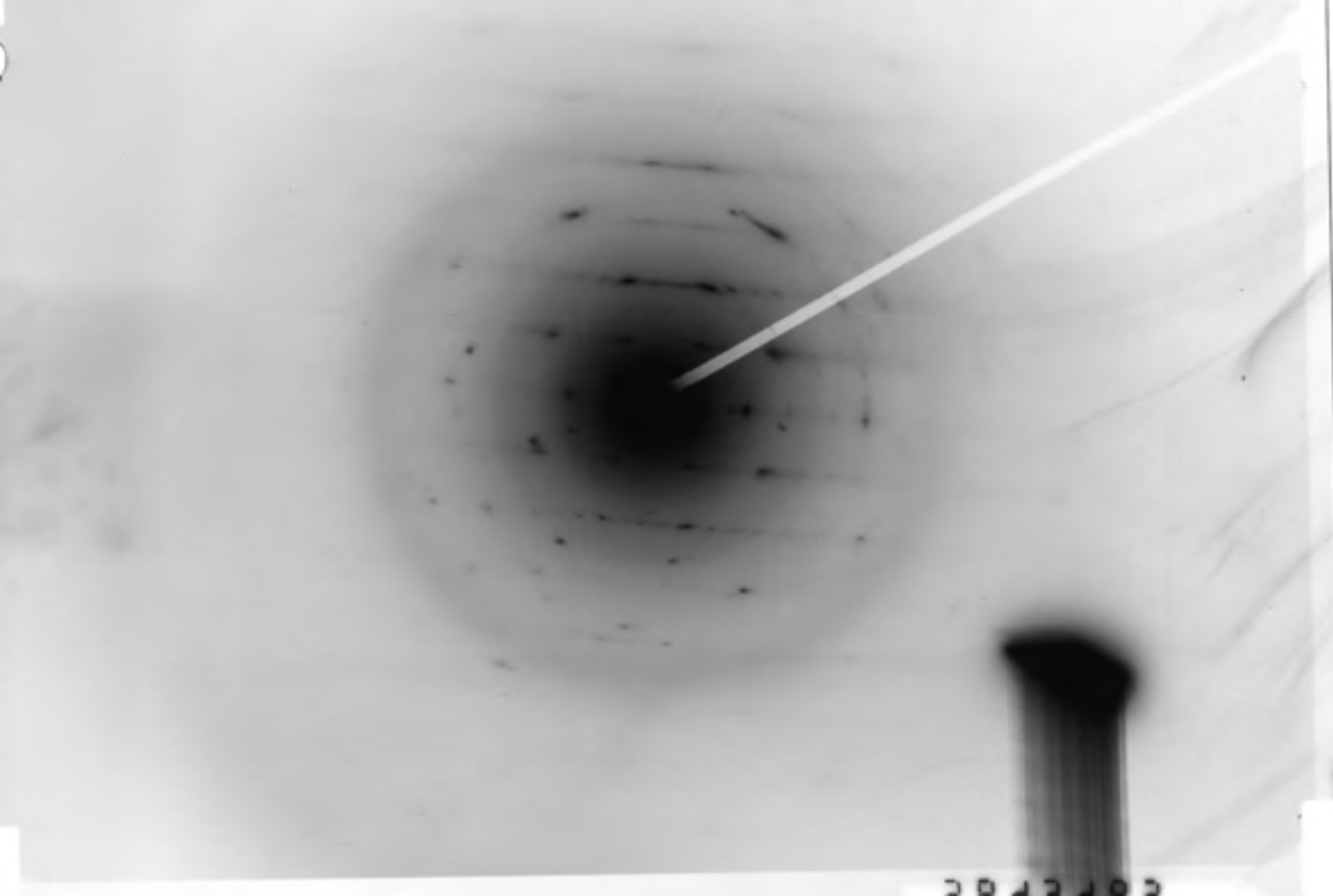
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.37**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	59	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0055 11/27/12 DM	Volume (L):	1589	Scope:	09-02
Customer Sample:	HM-OP-AA-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	I, 1-3	Analysis Date:	10/9/2012

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	10	none	3:1	5:1	
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
I1	H10	ND									
I1	H8	ND									
I1	H6	ND									
I1	H1	ND									
I2	C7	ND									
I2	C5	ND									
I2	C3	ND									
I3	E10	ND									
I3	E8	ND									
I3	E6	ND									

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	11/27/12 DMM 091211~~1~~943-0056	Volume (L):	1657	Scope:	09-02
Customer Sample:	HM-OP-AA-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	I, 4-6	Analysis Date:	10/9/2012

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	9	none	3:1	5:1	
GO Analyzed:	9 11/27/12 DMM				
Level of Analysis Chrysotile:	CD~~Q~~	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
I4	F5	ND									
I4	F7	ND									
I4	F9	ND									
I5	F1	ND									
I5	F3	B	1	1	14.5	4.6	CD	CHRYS		43966	YES
I5	F3	B	2	2	10.6	1.8	CD	CHRYS			
I5	F5	ND									
I6	F1	ND									
I6	F3	ND									
I6	F5	ND									

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

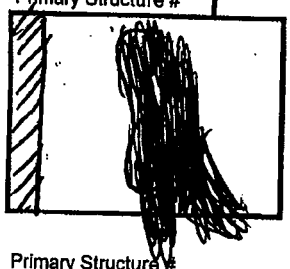
EMSL Order ID: 09121943-0056

Client:

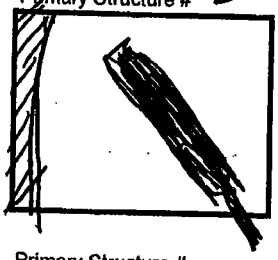
Client Sample:

Page 1 of 1

Primary Structure # 1



Primary Structure # 2



Primary Structure #

Primary Structure #

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Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

Analyst: KD

Date: 9 OCT 12

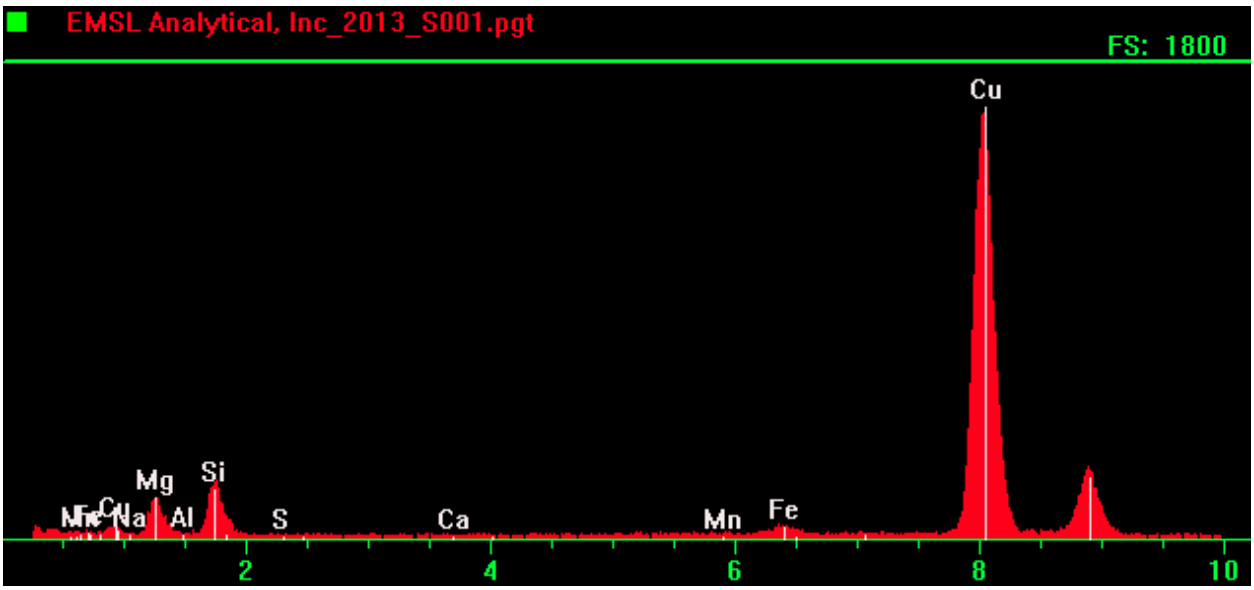
Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0056_TEM_ISO_10312_EDX_Chrysotile
Collected: October 09, 2012 15:35:40

Live Time:	31.23	Count Rate:	3747	Dead Time:	44.19 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	16.4	14.4	0.0	0.0
Mg	KA1	96.8	14.6	82.2	5.6
Al	KA1	17.1	15.2	1.9	0.1
Si	KA1	140.0	14.4	125.6	8.7
S	KA1	12.2	11.3	0.9	0.1
Ca	KA1	14.0	12.9	1.1	0.1
Mn	KA1	19.3	19.1	0.2	0.0
Fe	KA1	51.6	19.6	32.0	1.6
Cu	KA1	1604.6	27.5	1577.1	57.4

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43966 SCOPE #: 2

Reference / Sample Number: 56

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

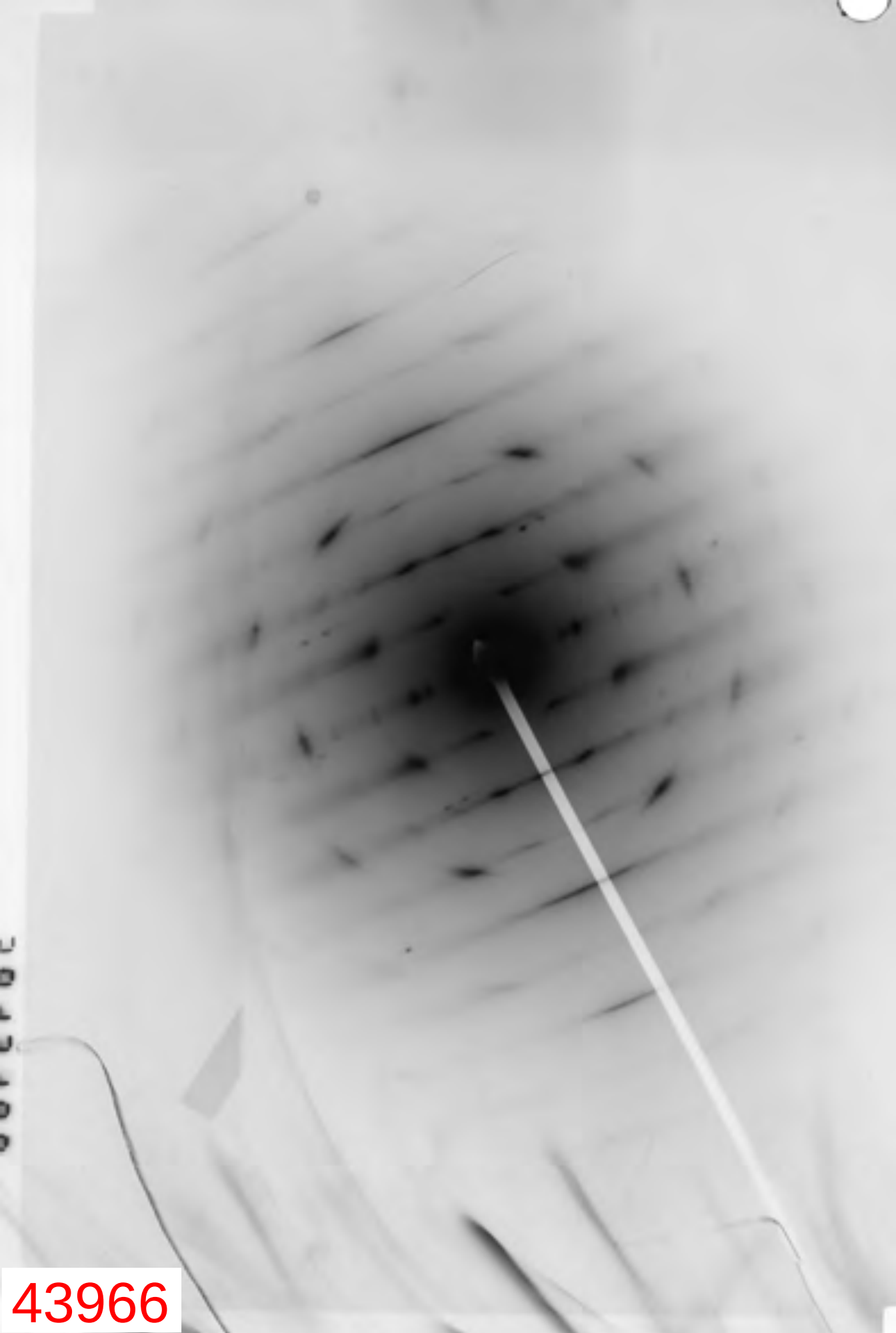
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43966

ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	091211~~1~~943-0057	Volume (L):	720	Scope:	09-02
Customer Sample:	HM-BG-ATV-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	J, 1-3	Analysis Date:	10/9/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	0				OVERLOADED
Level of Analysis Chrysotile:	CD~~Q~~ 11/27/12 DM	Min Length:	> 5	micron	28%
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211~~1~~943-0057 11/29/12 DM	Volume (L):	720	Scope:	04-01
Customer Sample:	HM-BG-ATV-01	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121002~~ 04/2 ERRG-01 11/29/12 DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~1-13~~ 6/4-6	Analysis Date:	11/9/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		**Comments:** 30% PART. LOADING VERTICAL TD
GO Required:	11	none	3:1 5:1	
GO Analyzed:	~~8~~ 11			
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM	Min Length:	> 5 micron	
Level of Analysis Amphibole:	ADX	Min Width:	≥ 0.25 micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
64	B9	ND									
	C5	MD11	1		15.6	2					
		MF		1	15.6	1	ADX	ACT		011405	1
		MD11	~~7~~ 2		~~76.5~~ 23	16.5					
		MB		2	14	1	CD	CH		011407	1
	E7	~~MD3~~									
		MC32	3	3	86	69	CD	CH			
		MD11	4		27.5	15					
		MB		4	11	1.8	CD	CH			
		MC11	5	5	21	12.5	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	11/29/12 DM 0912111943-0057	Volume (L):	720	Scope:	04-01
Customer Sample:	HM-BG-ATV-01	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121002~~ 0412 ERRG-01 11/29/12	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~1-13~~ 6/4-6 DM	Analysis Date:	11/9/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		**Comments:** 30% PART. LOADING VERTICAL TD
GO Required:	11	none	3:1 5:1	
GO Analyzed:	~~8~~ 11 11/29/12 DM			
Level of Analysis Chrysotile:	CDQ 11/29/12 DM	Min Length:	> 5 micron	
Level of Analysis Amphibole:	ADX	Min Width:	≥ 0.25 micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
G4	E10	MC11	6	6	54	29	CD	CH			
		MD22	7		29.8	26					
		MF		7	29.8	.25	ADX	ACT			
		MB		8	6.3	.4	CD	CH		01H08	
	G8	MD11	8		26	16.5					
		MB		9	15.5	1.2	CD	CH		01H09	
		MD11	9		63	49					
		MB		10	34.5	1	CD	CH		01H10	
		MD11	10		7.2	2.5					
		MF		11	7.2	1.5	ADX	ACT			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	11/29/12 DM 0912117943-0057	Volume (L):	720	Scope:	04-01
Customer Sample:	HM-BG-ATV-01	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121002~~ 04/2 ERRG-01 11/29/12 DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~J-13~~ G/4-6	Analysis Date:	11/9/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		**Comments:** 30% PART. LOADING VERTICAL TD
GO Required:	11	none	3:1	5:1
GO Analyzed:	~~0~~ 11 11/29/12 DM			
Level of Analysis Chrysotile:	CD~~0~~	Min Length:	> 5 micron	
Level of Analysis Amphibole:	ADX	Min Width:	≥ 0.25 micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
G4	I7	MC11	11	12	22	18	CD	CH	+2NAM		12/4/12 DM
		MC11	12	13	26	22	ADX	ACT		011411	
G5	B4	MC11	13	14	36	35	CD	CH			
		MC11	14	15	25	22.5	CD	CH			
	D2	ND									
	E5	MD11	15		86	34					
		MB		16	33.6	1.6	CD	CH			
	G3	MC11	16	17	47	32.6	CD	CH		+1NAM	
	I5	MD11	17		11.3	8					
		MB		18	11.3	.75	CD	CH			

ISO 10312

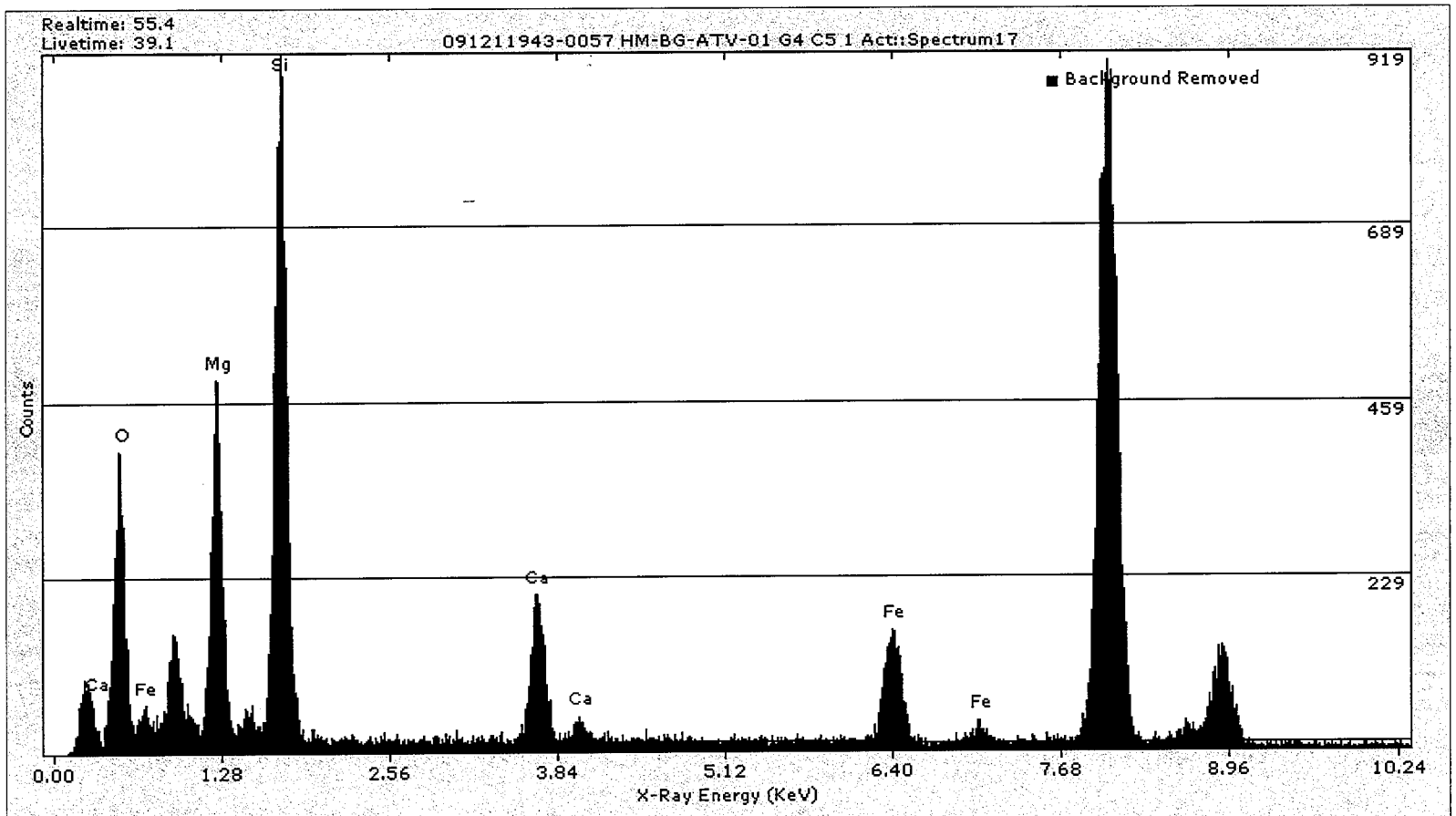
TEM Asbestos Count Sheet

EMSL Sample ID:	11/29/12 DM 0912117943-0057	Volume (L):	720	Scope:	04-01
Customer Sample:	HM-BG-ATV-01	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~121002~~ 09/2 ERRG-01 11/29/12 DM	Analyzed By:	F CRAIG
EFA (mm^2):	385	Grid Location:	~~J-1-3~~ G/4-6	Analysis Date:	11/9/12

Analysis Information

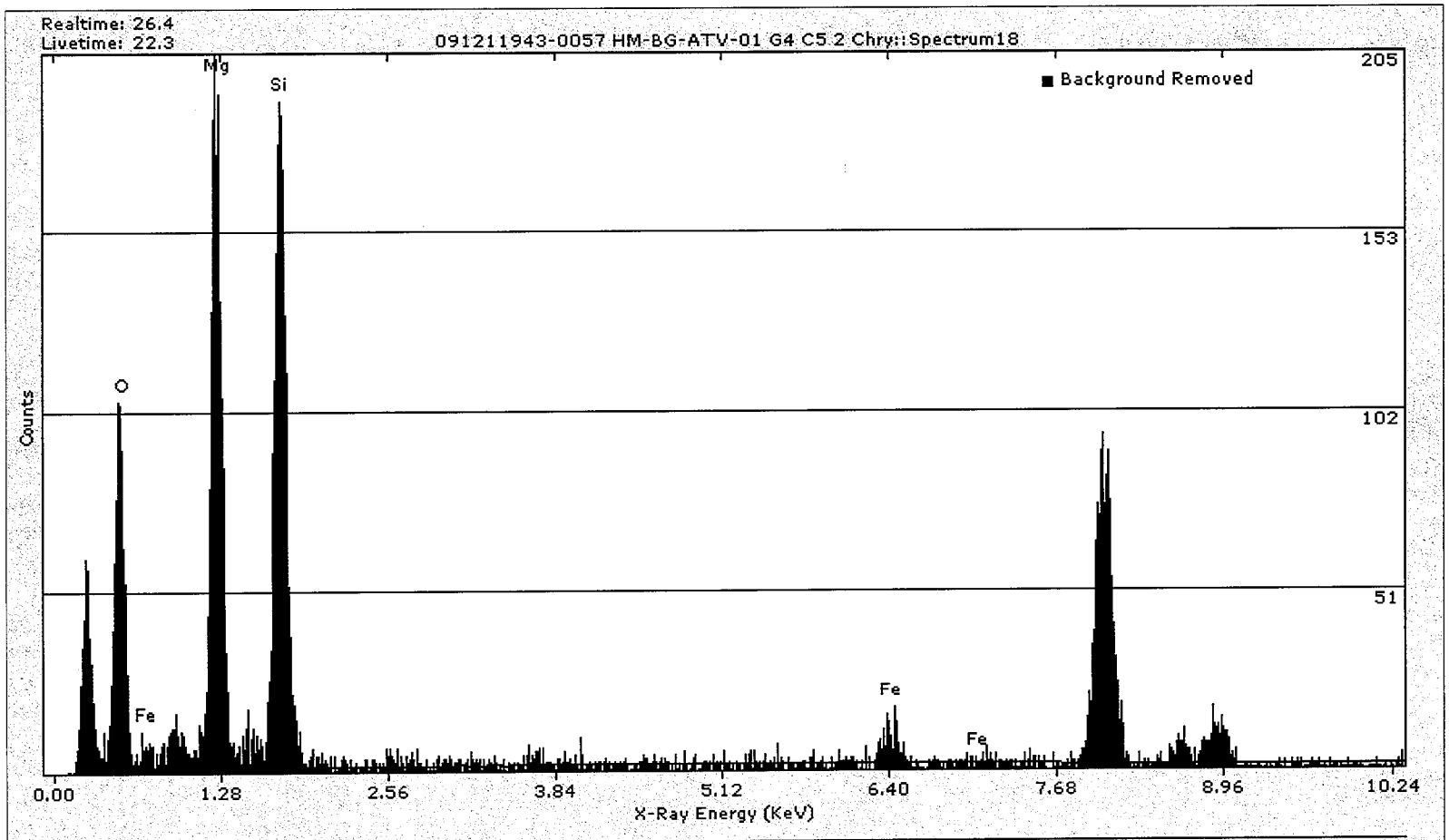
Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		**Comments:** 30% PART. LOADING VERTICAL TD
GO Required:	11	none	3:1	5:1
GO Analyzed:	~~9~~ 11 11/29/12 DM			
Level of Analysis Chrysotile:	CD~~Q~~	Min Length:	> 5 micron	
Level of Analysis Amphibole:	ADX	Min Width:	≥ 0.25 micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	Total	Length	Width					
G5	I5	MD11	18		34.5	12					
		MB		19	7.5	1	CD	CH			
		MD11	19		15	5.6					
		MB		20	14.8	1.7	CD	CH			
		MD11	20		27	17					
		MB		21	27	1	CD	CH			



Quantitative Results for Spectrum17
Analysis: Thin Film Method: Standardless
Acquired 09-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	45.06	0.97	60.33	0.00		0.0000	0.0	85.8	2938.33
Magnesium	14.75	0.17	13.00	24.46	(MgO)	0.2329	3515.0	95.5	3554.38
Silicon	27.10	0.31	20.67	57.97	(SiO2)	0.3993	7528.3	101.4	7692.65
Calcium	6.47	0.07	3.46	9.06	(CaO)	0.0552	1870.5	122.1	1965.19
Iron	6.62	0.08	2.54	8.51	(FeO)	0.0498	1519.0	146.1	1797.20
Total	100.00			100.00					



Quantitative Results for Spectrum18
Analysis: Thin Film Method: Standardless
Acquired 09-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.43	1.17	58.86	0.00		0.0000	0.0	85.8	743.97
Magnesium	27.33	0.69	22.80	45.32	(MgO)	0.3812	1489.6	95.6	1553.49
Silicon	24.53	0.62	17.72	52.49	(SiO2)	0.3189	1563.1	101.4	1623.02
Iron	1.71	0.04	0.62	2.20	(FeO)	0.0131	89.7	146.2	118.10
Total	100.00			100.00					

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 09, 2012

Image Number: 011405

Sample Number: 0057-04-01

Preliminary ID: Actinolite

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

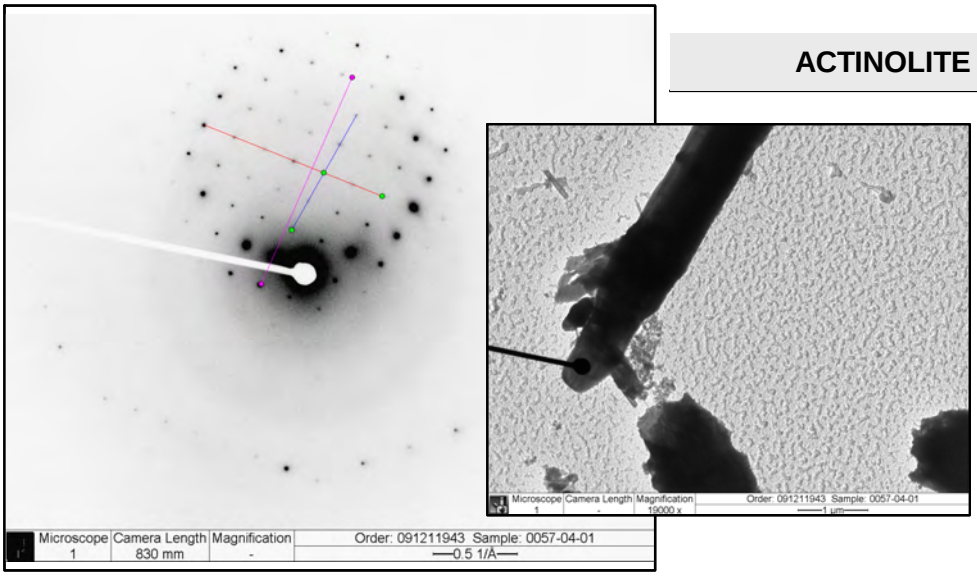
	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.243**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**5.086**	5.099	**4.834**	**5.342**
d1 or hkl (Camera K/slant vector dist.):	**5.166**	5.158	**4.900**	**5.416**
Ratio of hk0/hkl:	**0.985**	0.989	**0.940**	**1.038**
Vector Angle:	**82.2**	82.100	**77.995**	**86.205**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of:

ACTINOLITE

With a Zone Axis of:

[**-3 -1 0**]



Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By:

F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 09, 2012

Image Number: 011407

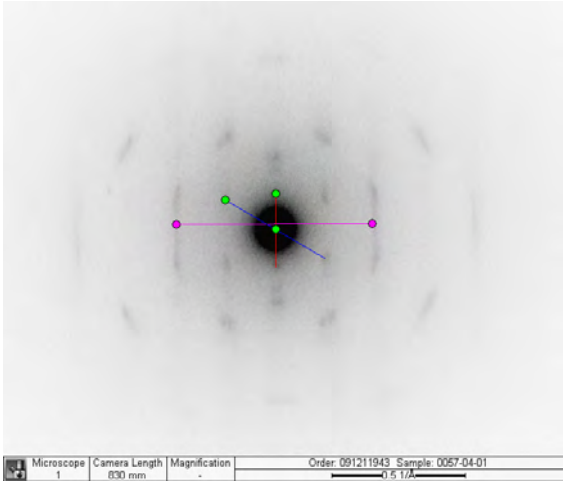
Reference / Sample Number: 0057

Preliminary ID: Chrysotile

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.370**	5.3	**5.06**	**5.56**
Vector Angle:	**59.6**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.285**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.637**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

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CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 09, 2012

Image Number: 011408

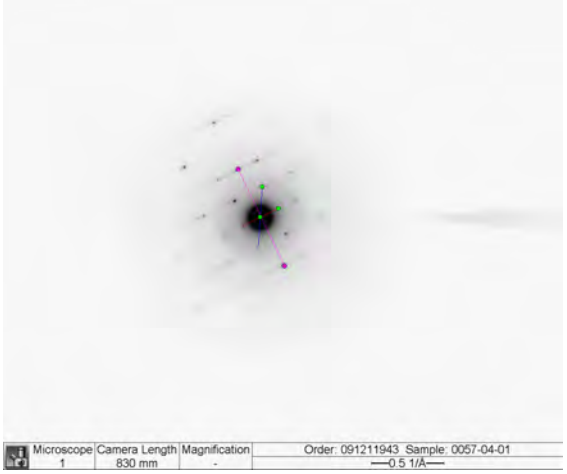
Reference / Sample Number: 0057

Preliminary ID: Chrysotile

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.429**	5.3	**5.06**	**5.56**
Vector Angle:	**60.4**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.248**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.696**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

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CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 09, 2012

Image Number: 011409

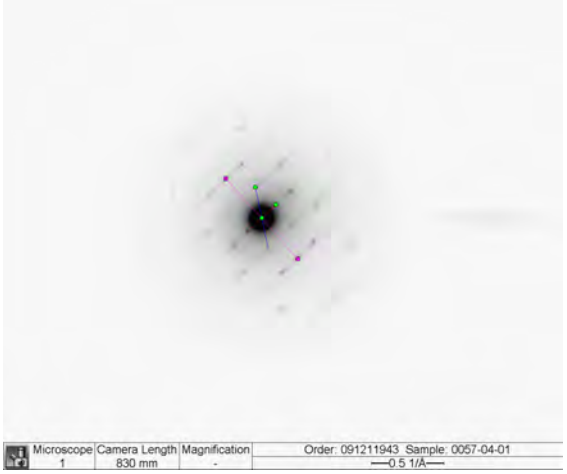
Reference / Sample Number: 0057

Preliminary ID: Chrysotile

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.406**	5.3	**5.06**	**5.56**
Vector Angle:	**58.2**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.312**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.637**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

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CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 09, 2012

Image Number: 011410

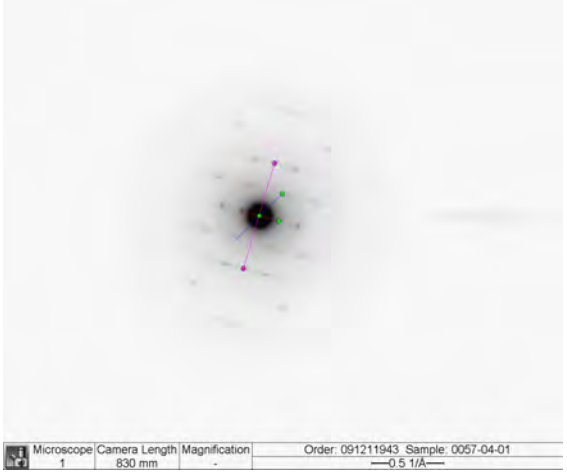
Reference / Sample Number: 0057

Preliminary ID: Chrysotile

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.300**	5.3	**5.06**	**5.56**
Vector Angle:	**59.4**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.428**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.540**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

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TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 09, 2012

Image Number: 011411

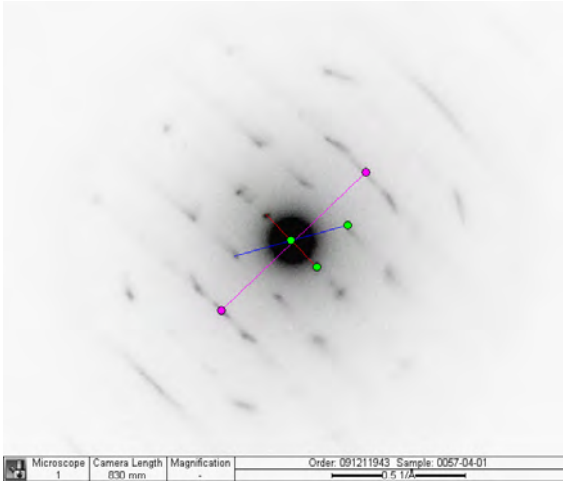
Reference / Sample Number: 0057

Preliminary ID: Chrysotile

Camera Constant: 2.952e-003 **1/A Pixels**

Calibration Reference: 110712.AuCal_11366

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.351**	5.3	**5.06**	**5.56**
Vector Angle:	**61.1**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.369**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.571**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	0912117943-0058	Volume (L):	582	Scope:	09-02
Customer Sample:	HM-BG-ATV-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	J, 4-6	Analysis Date:	10/9/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	13	none	3:1	5:1	
GO Analyzed:	0	11/27/12 DM			OVERLOADED
Level of Analysis Chrysotile:	CDØ	Min Length:	> 5	micron	35%
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

12/4/12 DM

EMSL Sample ID:	0912111943-0058	Volume (L):	582	Scope:	06-02
Customer Sample:	HM-BG-ATV-02	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	Chris Chen / Dan Clark
EFA (mm^2):	385	Grid Location:	Q 1,2,3	Analysis Date:	11/14/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	23	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 DM
GO Analyzed:	23				Particulate: 35% Loading
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
Q1	M2	MD11	1		16.5	7.5					
		MB		1	7.2	1.0	CHQ	Chrysotile			
		MD11	2		9.25	7					
		MF		2	6.2	1.25	ADX	Actinolite			
		MD11	0		11.5	3.0					
		MF		0	5.5	1.0	NAM	NAM			
		MD11	3		12	8.5					
		MB		3	6.5	0.75	CHQ	Chrysotile			
	M5	MD11	4		16	5.25					
		MB		4	16	0.8	CHQ	Chrysotile			

ISO 10312

TEM Asbestos Count Sheet

12/4/12 DM

EMSL Sample ID:	091211/943-0058	Volume (L):	582	Scope:	06-02
Customer Sample:	HM-BG-ATV-02	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	C. Chan
EFA (mm^2):	385	Grid Location:	Q 1,2,3	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	23	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 DM
GO Analyzed:	23				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
21	M5	MD11	0		22	18					
		MF		0	5.5	0.3	NAM	NAM			
		MD11	5		8.2	7.3					
		MB		5	8.2	25	CMQ	Chrysotile			
	M9	MD11	0		17	6					
		MB		0	5.5	0.3	NAM	NAM			
		MD22	6		26	22					
		MB		6	26	3	~~CMQ~~ CDQ CMQ	Chrysotile	① ②	84527	✓
		MB		7	10	2.5	CMQ	Chrysotile			
		MD11	7		15	12					
		MB		8	9	0.3	CMQ	Chrysotile			

ISO 10312

TEM Asbestos Count Sheet

12/4/12 DM

EMSL Sample ID:	0912111943-0058	Volume (L):	582	Scope:	06-02
Customer Sample:	HM-BG-ATV-02	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	C. Chan
EFA (mm^2):	385	Grid Location:	Q 1,2,3	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	23	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 DM
GO Analyzed:	23				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
Q1	M11	NSD									
	K11	MD22	8		22	17					
		MB		~~129~~	12	0.5	EDQ ~~EMQ~~	Chrysotile			
		MF		0	7.5	1.0	NAM	NAM			
		MD11	0		9.5	12.5					
		MF		0	8	1.2	NAM	NAM			
	I1	MD11	0		7.5	5.5					
		MB		0	6.5	1.1	NAM	NAM			
	I3	MD11	0		9.5	3					
		MF		0	5.1	0.5	NAM	NAM			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	1214/12-DM 0912111943-0058	Volume (L):	582	Scope:	OC-02
Customer Sample:	HM-BG-ATV-02	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	C. Chan
EFA (mm^2):	385	Grid Location:	Q 1,2,3	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	23	none	3:1	5:1	~~OVERLOADED~~ 1214/12-DM
GO Analyzed:	23				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	Total	Length	Width					
Q1	I8	MD11	9		12	8					
		MB		10	10	0.65	CHQ	Chrysotile			
	I10	MD11	10		13.5	4.2					
		MF		11	7.3	1.5	CHQ	Chrysotile			
		F	0	0	8.5	2.0	NAM	NAM			
	A5	NSD									
Q2	D1	MD11	11		11.6	4.5					
		MF		12	7.3	1.1	CHQ	Chrysotile			
		MD11	0		10	3.6					
		MB		0	9.5	0.85	NAM	NAM			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**0912111943-0058**	Volume (L):	582	Scope:	06-02
Customer Sample:	HM-BG-ATV-02	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	C. Chan
EFA (mm^2):	385	Grid Location:	Q 1,2,3	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	23	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 OM
GO Analyzed:	23				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
Q2	F1	B	12	13	8.5	1.1	CHQ	Chrysotile			
		~~HD11~~ 22	12/4/12 OM 13		16.5	8.2					
		MB		14	5.5	0.35	CHQ	Chrysotile			
		MB		15	5.1	0.5	CHQ	Chrysotile			
	D2	F	0	0	8.25	1.15	NAM	NAM			
Q3	C1	HD11	~~9.5~~ 14	2	9.5	2					
		MB		16	9.5	1	CHQ	Chrysotile			
		HD11	15		11	9					
		MB		17	5.5	0.75	CHQ	Chrysotile			
		HD22	0								
				0	0	0	NAM	NAM			
				0	0	0	NAM	NAM			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211/943-0058 12/4/12 am	Volume (L):	582	Scope:	OU-02
Customer Sample:	HM-BG-ATV-02	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	C. Chan
EFA (mm^2):	385	Grid Location:	Q 1,2,3	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	23	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 am
GO Analyzed:	23				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
Q3	C5	MD11	0		17	15					
		MF		0	8	0.35	NAM	NAM			
	B10	B	16	18	6	0.6	CHQ	Chrysotile			
		MD11	17		13	5					
		MB		19	10	0.3	CHQ	Chrysotile			
		~~BF~~ Actinolite	18	20	6	0.25	ADX	Actinolite		84508	✓
		B	19	21	5	0.3	CHQ	Chrysotile			
		MD11	20		8	5.3					
		MB		22	7.5	1.0	CHQ	Chrysotile			
		F	~~5.3~~ 0	0	5.3	~~0.35~~	NAM	NAM			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0058	Volume (L):	582	Scope:	OE-02
Customer Sample:	HM-BG-ATV-02	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	C. chan
EFA (mm^2):	385	Grid Location:	Q 1,2,3	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	23	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 DM
GO Analyzed:	23				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
Q3	C12	B	21	23	5.5	.50	CMQ	Chrysotile			
		MD22	22		7.5	6					
		MF		24	5.5	.60	ADX	Actinolite			
		MF		25	5.5	.25	ADX	Actinolite			
	B14	MD11	23		7.0	1.0					
		MF		26	6.0	.40	CMQ	Chrysotile			
		MD11	24		7.0	5.0					
		MB		27	6.0	2.0	CMQ	Chrysotile			
		F	0	0	7	.5	.	NAM			
		MD11	25		8.0	5.0					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0058	Volume (L):	582	Scope:	06-02
Customer Sample:	HM-BG-ATV-02	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	C. Chan
EFA (mm^2):	385	Grid Location:	Q 1,2,3	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	23	none	3:1	5:1	~~OVERLOADED~~ 11/14/12 DM
GO Analyzed:	23				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
Q3	B14	MB		28	6.5	.65	CMQ	Chrysotile			
	E13	MD11	26		5.5	1.5					
		MF		29	5.5	.75	ADX	Actinolite			
		B	27	30	6.5	1.0	CMQ	Chrysotile			
		B	28	31	6.0	.75	CMQ	Chrysotile			
		B	29	32	6.0	.75	CMQ	Chrysotile			
	H1	F	0	0	8.0	1.0		NAM			
		MD11	30		7.0	5.0					
		MF		33	7.0	.75	ADX.	Actinolite			
		B	31	34	6.0	.75	CMQ	Chrysotile			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0058	Volume (L):	582	Scope:	06-02
Customer Sample:	HM-BG-ATV-02	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	C. Chan
EFA (mm^2):	385	Grid Location:	Q 1,2,3	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	23	none	3:1	5:1	~~OVERLOADED~~ 11/14/12
GO Analyzed:	23				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	Total	Length	Width					
Q3	I5	B	32	35	7.5	1.75	CMQ	Chrysotile			
	K6	MD11	33		15.0	5.0					
		MB		36	6.0	1.0	CMQ	Chrysotile			
		F	0	0	8.0	1.5		NAM			
		MD11	34		7.0	6.0					
		MB		37	6.0	.75	CMQ	Chrysotile			
		MD11	35		9.0	10.0					
		MB		38	7.0	.75	CMQ	Chrysotile			
	I9	B	36	39	10.0	2.0	CMQ	Chrysotile			
		F	0	0	7.5	1.0		NAM			

EMSL ANALYTICAL, INC.

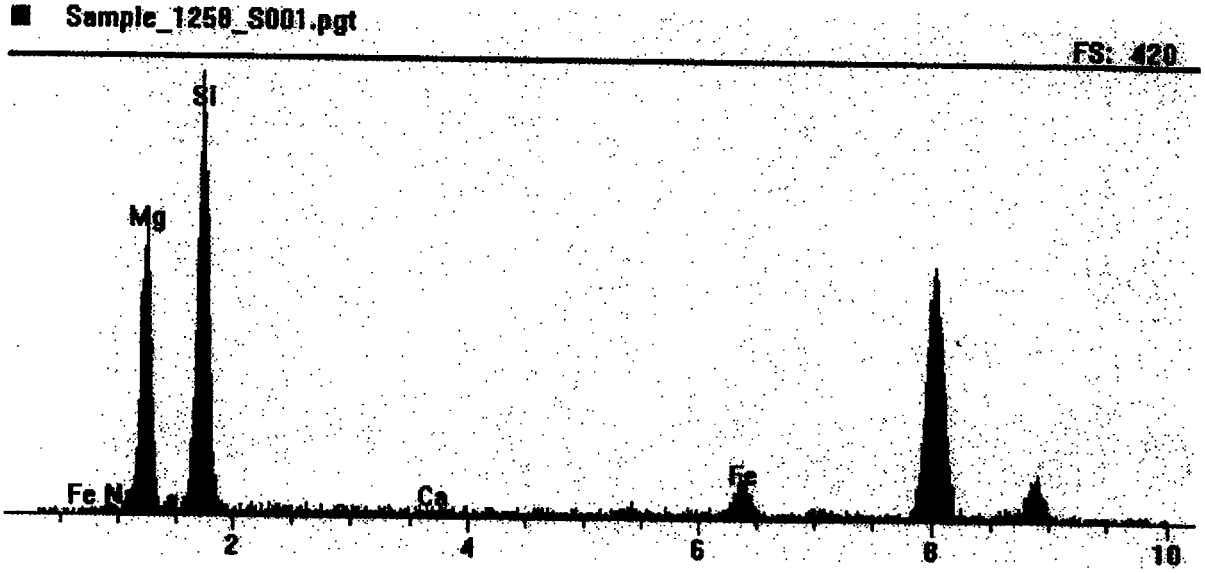
Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

091211\943-0058 12/4/12 DM
HM-BG-ATV-02
ISO2012-1
Q1:M9
Chrysotile.

File: C:\Program Files\PGT\Data\Sample_1258_S001.pgt
Collected: November 14, 2012 06:34:21

Live Time:	7.71	Count Rate:	4211	Dead Time:	37.72 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

■ Sample_1258_S001.pgt



Element	Line	keV	KRatio	Wt%	At%	ChiSquared
Mg	KA1	1.254	0.2112	29.84	34.99	0.65
Ca	KA1	3.691	0.0038	0.47	0.33	1.24
Fe	KA1	6.403	0.1043	12.29	6.27	0.82
Si	KA1	1.740	0.3535	56.88	57.76	1.51
Na	KA1	1.041	0.0029	0.52	0.65	0.65
Total			**0.6757**	**100.00**	**100.00**	**39.43**

Element	Line	Gross (cps)	BKG (cps)	Overlap (cps)	Net (cps)	P:B Ratio
Mg	KA1	600.6	13.1	0.0	587.5	44.9
Ca	KA1	23.3	16.1	0.0	7.2	0.4
Fe	KA1	119.8	14.0	0.0	105.8	7.6
Si	KA1	966.0	16.9	0.0	949.2	56.3
Na	KA1	17.3	9.7	0.1	7.4	0.8

Element	Line	Det Eff	Z Corr	A Corr	F Corr	Tot Corr	Modes
Mg	KA1	0.858	0.975	1.472	0.985	1.413	Element
Ca	KA1	0.929	1.038	1.202	0.993	1.238	Element
Fe	KA1	0.982	1.155	1.020	1.000	1.178	Element
Si	KA1	0.889	0.988	1.628	1.000	1.609	Element
Na	KA1	0.788	0.991	1.876	0.978	1.819	Element

EMSL ANALYTICAL, INC.

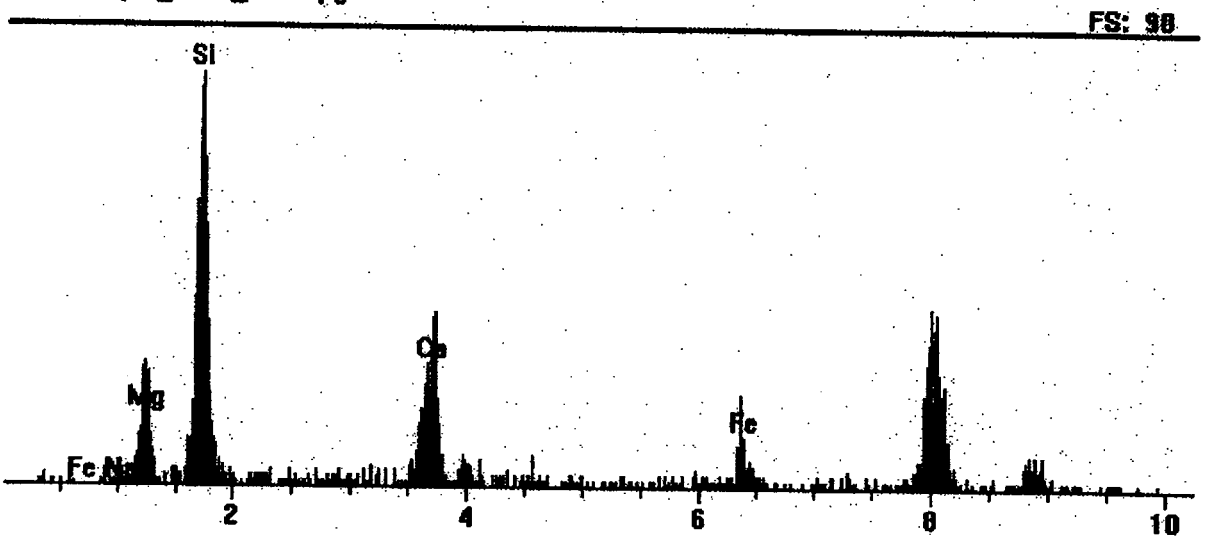
Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

0912111943-0058 12/4/12 DM
HM-BG-ATV-02
Actinolite
ISO2012-1
Q3:B10

File: C:\Program Files\PGT\Data\Sample_1258_S001.pgt
Collected: November 14, 2012 06:34:21

Live Time:	8.87	Count Rate:	629	Dead Time:	7.31 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

■ **Sample_1258_S001.pgt**



Element	Line	keV	KRatio	Wt%	At%	ChiSquared
Mg	KA1	1.254	0.1069	17.62	22.75	1.11
Ca	KA1	3.691	0.2054	24.12	18.89	1.61
Fe	KA1	6.403	0.1016	12.15	6.83	1.39
Si	KA1	1.740	0.3105	46.11	51.53	0.87
Na	KA1	1.041	0.0000	0.00	0.00	
Total			**0.7245**	**100.00**	**100.00**	**5.43**

Element	Line	Gross (cps)	BKG (cps)	Overlap (cps)	Net (cps)	P:B Ratio
Mg	KA1	38.7	5.6	0.0	33.1	5.9
Ca	KA1	67.2	7.8	0.0	59.4	7.6
Fe	KA1	24.6	0.0	0.0	24.6	0.0
Si	KA1	160.2	3.6	0.0	156.6	43.4
Na	KA1	2.7	3.2	0.0	0.0	0.0

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 09/211943 12/11/12 pm DATE: 12/4/12

Indexing of negative number: 84527 SCOPE #: 06-02

Reference / Sample Number: 58

Preliminary ID: Chrysotile By: CC

Using Camera Constant of: 21.48 mm Angstroms

Determined from negative number: 84515

Quick Check

Measured Inter-row spacing: 4.0 mm

110 reflections present? Enter Yes or No YES

200 doublets present? Enter Yes or No YES

Full Index

Measured distance, center spot to closest hk0 spot (002):		mm
Measured distance, center spot to closest hk1 spot (110):		mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	5.37	5.30	5.035	5.565
Angle to 110 reflection (Measured °)	60	60	57.000	63.000
d2 or d hk 0 (002) (Angstroms)		7.32	6.954	7.686
d1 or d hk 1 (110) (Angstroms)		4.58	4.351	4.809

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: chrysotile By: [signature]

Preliminary Identification was: [✓] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 0912111943 DATE: 12/4/12

Indexing of negative number: 84528 SCOPE # 06-02

Reference / Sample Number: 58

Preliminary ID: Actinolite By: CC

Using Camera Constant of: 21.48 mm Angstroms

Determined from negative number: 84515

Measured Inter-row spacing: 4.0mm mm
Mean Distance between spots on Center row (d2): 2.40 mm
Mean distance between spots on slant vector (d1): 4.70 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	5.37	5.3	~~5.065~~ 5.035	~~5.565~~ 5.565
d2 or hk0 (Camera K/zero row dist.)	8.95	9.055	8.602	9.503
d1 or hk1 (Camera K/slant vector dist.)	4.57	4.482	4.258	4.706
Ratio of hk0/hk1	1.95	2.020	1.919	2.121
Angle of Slant Vector (Measured)	61°	60.33	57.31	63.35

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: [signature]
With a Zone Axis of: [1 0 0]

Preliminary Identification was: [✓] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

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8 JAN 94

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211~~1~~943-0059 11/27/12 DM	Volume (L):	615	Scope:	09-02
Customer Sample:	HM-BG-ATV-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	K, 1-3	Analysis Date:	10/9/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	13		none	3:1	5:1
GO Analyzed:	0				
Level of Analysis Chrysotile:	CD~~Q~~ 11/27/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

OVERLOADED
35%

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

12/4/12 DM

EMSL Sample ID:	0912111943-0059	Volume (L):	615	Scope:	06-02
Customer Sample:	HM-BG-ATV-03	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	Daniel Clarke
EFA (mm^2):	385	Grid Location:	Q 4,5,6	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	22	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 DM
GO Analyzed:	22				Particulate Loading: 35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
Q4	N2	B	1	1	6.5	1.0	CMQ	Chrysotile	—		Y
		B	2	2	12.5	1.5	CMQ	chrysotile	—		
	M4	F	0	0	6.0	.75		NAM			
	N6	MD11	3		6.5	1.4					
		MB		3	6.5	.25	CMQ	chrysotile			
		F	0	0	11.0	.75		NAM	—		
	M8	F	0	0	6.5	1.0		NAM	—		
	N10	F	4	4	7.0	1.0	ADX	Actinolite	—		Y
		MD11	5		15.0	15.0					
		MF		5	11.0	.25	CMQ	chrysotile			

ISO 10312

TEM Asbestos Count Sheet

12/4/12 DM

EMSL Sample ID:	091211~~1~~943-0059	Volume (L):	615	Scope:	DU-02
Customer Sample:	HM-BG-ATV-03	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	D. Clarke
EFA (mm^2):	385	Grid Location:	Q 4,5,6	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	22	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 DM
GO Analyzed:	22				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
Q4	N10	F	0	0	7.5	.75		NAM			
		B	6	6	12.5	.25	CMQ	Chrysotile			
		F	0	0	14.0	1.5		NAM			
	M12	MD11	7		12.0	7.0					
		MB		7	5.5	.75	CMQ	Chrysotile			
		B	8	8	6.5	1.0	CMQ	Chrysotile			
		B	9	9	11.0	1.0	CMQ	Chrysotile	Bifid		
	H2	F	0	0	5.0	1.0		NAM			
		B	10	10	5.5	.40	CMQ	Chrysotile			
		MD22	11		9.0	6.0					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	1214/12-OM 091211/943-0059	Volume (L):	615	Scope:	OLE-02
Customer Sample:	HM-BG-ATV-03	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	D. Clarke
EFA (mm^2):	385	Grid Location:	Q 4,5,6	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	22	none	3:1	5:1	~~OVERLOADED~~ 1214/12-OM
GO Analyzed:	22				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
Q4	H2	MB		11	8.5	1.0	CMQ	Chrysotile			
		MB		12	7.5	.75	CMQ	Chrysotile	(11) (12)		
	J4	B	12	13	6	.75	ADX	Actinolite		84525	
		MD11	13		18.5	4.0					
		MB		14	18.5	1.0	CMQ	Chrysotile			
	I6	MD11	14		7.0	2.0					
		MB		15	5.5	1	CMQ	Chrysotile			
		MD11	15		10.0	15.0					
		MB		16	10.0	.50	CMQ	Chrysotile			
		MD11	16		10.0	10.0					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0059 12/4/12 DM	Volume (L):	615	Scope:	Ole 02
Customer Sample:	HM-BG-ATV-03	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	D. Clarke
EFA (mm^2):	385	Grid Location:	Q 4,5,6	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	22	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 DM
GO Analyzed:	22				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
Q4	I6	MB		17	8.0	2.0	CMQ	Chrysotile			
		F	0	0	7.5	1.0		NAM			
	J7	MD22	17		12.0	12.0					
		MB		18	6.0	1.0	CMQ	Chrysotile	(18) (19)		
		MB		19	5.5	.75	CMQ	Chrysotile			
		B	~~20~~ 18 11/12/12	20	5.0	.50	CDX width DM	Chrysotile		84527 6	12/13/12 DM
Q5	L12	F	0	0	6	.65		NAM			
	L9	B	~~21~~ 19 11/12/12	21	20.5	1.0	CMQ	Chrysotile	GRED		
	M6	B	0	0	6	.50		NAM			
		MD11	20		16.0	15.0					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	12/4/12 DM 0912111943-0059	Volume (L):	615	Scope:	06-02
Customer Sample:	HM-BG-ATV-03	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	D. Clarke
EFA (mm^2):	385	Grid Location:	Q 4,5,6	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	22	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 DM
GO Analyzed:	22				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
Q5	M6	MB		22	5.0	.50	CMQ	Chrysotile			
	L4	MD11	21		20.0	10.5					
		MB		23	11.5	1.0	CMQ	Chrysotile			
		MD11	22		8.0	5.0					
		MB		24	6.0	.75	CMQ	Chrysotile			
		B	23	25	5.5	.75	CMQ	Chrysotile			
	C3	F	0	0	27.0	.25		NAM			
	B6	MD11	24		7.0	7.0					
		MF		26	5.5	.25	CMQ	Chrysotile			
	D8	MD11	25		12.0	8.0					

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	12/4/12 pm 0912111943-0059	Volume (L):	615	Scope:	OL-02
Customer Sample:	HM-BG-ATV-03	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	D. clarke
EFA (mm^2):	385	Grid Location:	Q 4,5,6	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	22	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 DM
GO Analyzed:	22				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
Q5	D8	MB		27	6.5	.25	CMQ	Chrysotile			
Q6	N9	F	26	28	6.0	.75	ADX	Actinolite			
		F	0	0	8.0	1.0		NAM			
		F	27	29	7.5	1.0	ADX	Actinolite			
	M5	MD11	28		7.5	2.5					
		MB		30	6.0	1.5	CMQ	chrysotile			
		MD11	29		10.0	7.0					
		MB		31	6.0	1.0	CMQ	chrysotile			
		MD22	30		12.0	18.0					
		MF		32	8.0	1.5	ADX	Actinolite	(32) (33)		

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211/1943-0059 12/4/12 DM	Volume (L):	615	Scope:	OLT-02
Customer Sample:	HM-BG-ATV-03	Prepped By:	CC	GO area (mm2):	0.0073
Sample Description:	AIR	Prepped Date:	11/13/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	ISO2012-1	Analyzed By:	D. Clarke
EFA (mm^2):	385	Grid Location:	Q 4,5,6	Analysis Date:	11/14/12

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	22	none	3:1	5:1	~~OVERLOADED~~ 12/4/12 DM
GO Analyzed:	22				35%
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
Q6	M5	MB		33	5.5	1.0	CMQ	chrysotile			
		MD11	31		15.0	5.0					
		MB		34	6.0	.75	CMQ	chrysotile			
		MD11	32		15.0	8.0					
		MB		35	12.0	1.0	CMQ	chrysotile			
	F9	F	0	0	7.5	1.0		NAM			
	B10	MD11	33		10.0	12.0					
		MB		36	8.0	.75	CMQ	chrysotile			
		F	34	37	5.0	.50	ADX	Actinolite			
	C12	B	35	38	10.0	2.0	CMQ	chrysotile			

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

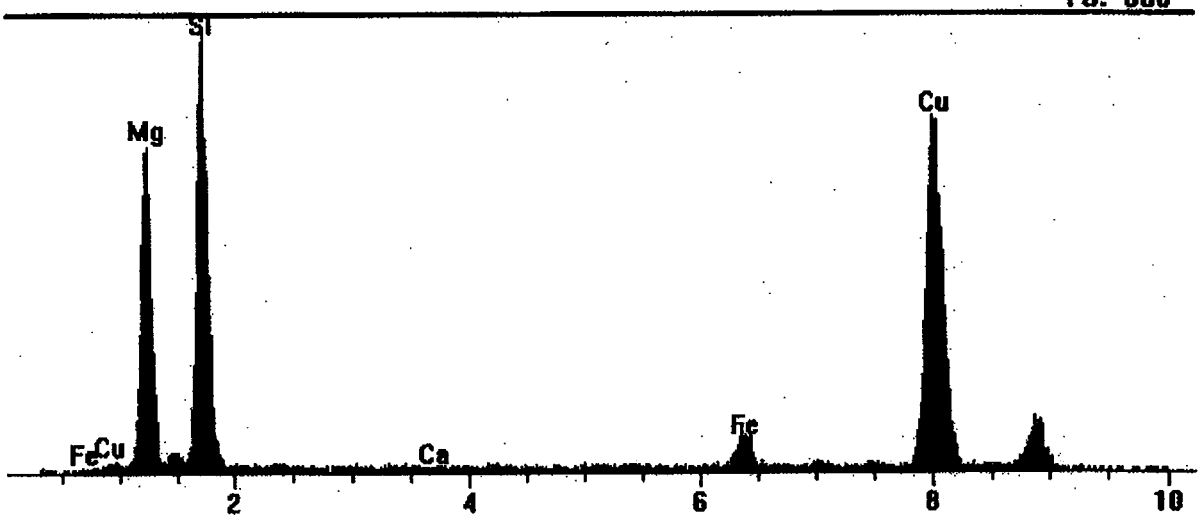
File: C:\Program Files\PGT\Data\Sample_1258_S001.pgt
Collected: November 14, 2012 06:34:21 MHlo-Dm

0912111943-0059
HM-BG-ATV-03
12I002 Q4:N2
CHRYSOTILE

Live Time:	30.88	Count Rate:	2255	Dead Time:	22.41 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

Sample_1258_S001.pgt

FS: 800



Element	Line	keV	KRatio	Wt%	At%	ChiSquared
Cu	KA1	8.046	0.4986	53.07	32.17	1.05
Mg	KA1	1.254	0.0662	23.75	37.62	0.87
Ca	KA1	3.691	0.0001	0.01	0.01	1.24
Fe	KA1	6.403	0.0282	2.32	1.60	1.21
Si	KA1	1.740	0.0990	20.85	28.60	1.65
Total			**0.6920**	**100.00**	**100.00**	**1.33**

Element	Line	Gross (cps)	BKG (cps)	Overlap (cps)	Net (cps)	P:B Ratio
Cu	KA1	569.2	9.1	0.0	560.2	61.8
Mg	KA1	322.8	9.2	0.0	313.6	34.0
Ca	KA1	8.3	8.0	0.0	0.2	0.0
Fe	KA1	57.6	8.3	0.0	49.3	5.9
Si	KA1	466.7	10.1	0.0	456.6	45.2

Element	Line	Det Eff	Z Corr	A Corr	F Corr	Tot Corr	Modes
Cu	KA1	0.989	1.058	1.006	1.000	1.064	Element
Mg	KA1	0.845	0.870	4.132	0.998	3.588	Element
Ca	KA1	0.920	0.924	1.167	0.980	1.057	Element
Fe	KA1	0.980	1.022	1.015	0.794	0.824	Element
Si	KA1	0.884	0.882	2.388	1.000	2.106	Element

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

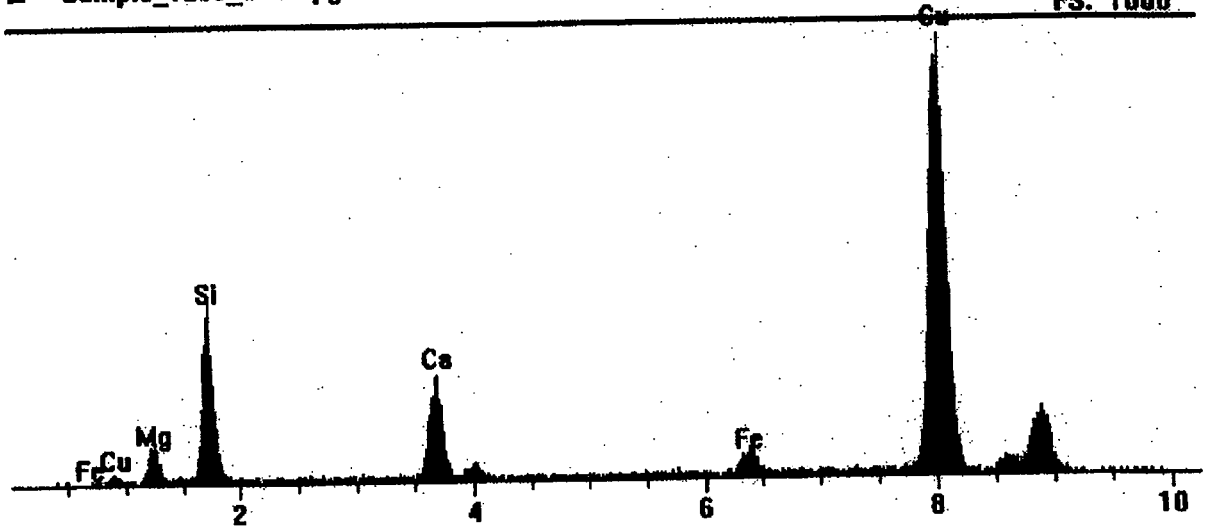
EMSL ANALYTICAL, INC.

File: C:\Program Files\PGT\Data\Sample_1258_S001.pgt
Collected: November 14, 2012 06:34:21 12/14/12 OM

0912111943-0059
HM-BG-ATV-03
12I002 Q4:N10
ACTINOLITE

Live Time:	27.19	Count Rate:	2530	Dead Time:	27.34 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00

Sample_1258_S001.pgt **FS: 1000**



Element	Line	keV	KRatio	Wt%	At%	ChiSquared
Cu	KA1	8.046	0.6956	73.76	57.27	2.32
Mg	KA1	1.254	0.0176	6.41	13.01	1.01
Ca	KA1	3.691	0.0638	6.66	8.20	2.46
Fe	KA1	6.403	0.0220	1.84	1.62	1.21
Si	KA1	1.740	0.0547	11.33	19.90	1.44
Total			**0.8537**	**100.00**	**100.00**	**2.01**

Element	Line	Gross (cps)	BKG (cps)	Overlap (cps)	Net (cps)	P:B Ratio
Cu	KA1	995.0	14.7	0.0	980.3	66.6
Mg	KA1	55.7	3.5	0.0	52.2	14.8
Ca	KA1	184.8	15.5	0.0	169.2	10.9
Fe	KA1	55.2	9.3	0.0	45.9	5.0
Si	KA1	251.4	5.8	0.0	245.5	42.0

Element	Line	Det Eff	Z Corr	A Corr	F Corr	Tot Corr	Modes
Cu	KA1	0.938	1.053	1.007	1.000	1.060	Element
Mg	KA1	0.399	0.867	4.207	0.998	3.638	Element
Ca	KA1	0.565	0.920	1.155	0.981	1.043	Element
Fe	KA1	0.884	1.017	1.024	0.800	0.834	Element
Si	KA1	0.650	0.878	2.361	0.999	2.072	Element

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 09121119 943 DILLBOM. DATE: 12/4/12

Indexing of negative number: 84525 SCOPE # 06-02

Reference / Sample Number: 59

Preliminary ID: Actinolite By: DC

Using Camera Constant of: 21.48 mm Angstroms

Determined from negative number: 84515

Measured Inter-row spacing: 4.1 mm
Mean Distance between spots on Center row (d2): 2.35 mm
Mean distance between spots on slant vector (d1): 4.25 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	5.23	5.3	5.035	5.565
d2 or hk0 (Camera K/zero row dist.)	9.14	9.055	8.602	9.503
d1 or hk1 (Camera K/slant vector dist.)	5.05	4.931	4.684	5.178
Ratio of hk0/hk1	1.810	1.836	1.744	1.928
Angle of Slant Vector (Measured)	72°	74.2	70.49	77.91

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: [signature]
With a Zone Axis of: [101]

Preliminary Identification was: [✓] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 09121943 DATE: 12/4/12

Indexing of negative number: 84526 SCOPE #: 06-02

Reference / Sample Number: 59

Preliminary ID: Chrysotile By: DC

Using Camera Constant of: 21.48 mm Angstroms

Determined from negative number: 84515

Quick Check

Measured Inter-row spacing: 4.0 mm

110 reflections present? Enter Yes or No YES

200 doublets present? Enter Yes or No YES

Full Index

Measured distance, center spot to closest hk0 spot (002):		mm
Measured distance, center spot to closest hk1 spot (110):		mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	5.37	5.30	5.035	5.565
Angle to 110 reflection (Measured °)	60	60	57.000	63.000
d2 or d hk 0 (002) (Angstroms)		7.32	6.954	7.686
d1 or d hk 1 (110) (Angstroms)		4.58	4.351	4.809

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile By: [signature]

Preliminary Identification was: [✓] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

8 JAN 94

8 JAN 94

8 JAN 94

8 JAN 94

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	11/27/12 DM 091211~~1~~943-0060	Volume (L):	660	Scope:	09-02
Customer Sample:	HM-BG-ATV-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	K, 4-6	Analysis Date:	10/9/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	12	none	3:1	5:1	OVERLOADED 25%
GO Analyzed:	0				
Level of Analysis Chrysotile:	CD~~O~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	11/29/12 DM 0912111943-0060	Volume (L):	660	Scope:	04 01
Customer Sample:	HM-BG-ATV-04	Prepped By:	PK	GO area (mm2):	~~0.0132~~
Sample Description:	AIR	Prepped Date:	9/19/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~0412-ERRG-01~~ ISO-002	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	0/1-3	Analysis Date:	11/16/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	12	none	3:1	5:1	
GO Analyzed:	12 11/29/12 DM				25% Particulate Loading
Level of Analysis Chrysotile:	CD~~Q~~	Min Length:	>5	micron	Vertical TD
Level of Analysis Amphibole:	ADX	Min Width:	≥0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
02	B8	NO									
	C5	↓									
	D7	↓									
	F9	MD11	1		58	29					
		MF		1	6.6	1.5	ADX	TREM		011434	1
	F4	MD11	2		12	6.5					
		MB		2	8.7	1.2	CD	CH		011436	1
	G6	MD11	3		14.5	4					
		MF		3	7.9	.4	ADX	TREM			
		MC11	4	4	22.5	16	ADX	TREM			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0060 11/29/12 DM	Volume (L):	660	Scope:	04 01
Customer Sample:	HM-BG-ATV-04	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~0412-ERRG-01~~ ISO-002	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	0/1-3 L/1-4 0412-ERRG-01	Analysis Date:	11/16/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12 11/29/12				
Level of Analysis Chrysotile:	CD~~Q~~ DM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

25% Particulate Loading
Vertical TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
02	I8	MD11	5		12.6	1.25					
		MB		5	12.6	1.25	CD	CH			
		MC11	6	6	29	29	CD	CH			
	I5	MD11	7		56	39					
		MB		7	36.6	3	CD	CH			
		MD11	8		18	17.8					
Begin Grid Box 0412-ERRG-01		MB		8	17.8	1.5	CD	CH			
L1	B3	MD11	0		27	18.5					
		MB		0	17	2	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211~~1~~943-0060 11/29/12 DM	Volume (L):	660	Scope:	04 01
Customer Sample:	HM-BG-ATV-04	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~0412-ERRO-01~~ ~~ISO-002~~ 0412-ERRA-01 11/29/12 DM	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	~~G/1-3~~ 11/29/12 DM L/1-4	Analysis Date:	11/16/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Q~~ 11/29/12 DM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

25% Particulate Loading
Vertical TD

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
L1	B3	MD21	9		15	14					
		MB		9	13.2	.7	CD	CH			
		MR10		0	2.5	.2	CD	CH			
		MD11	10		50	22					
		MB		10	41	3	CD	CH			
	C9	ND									
	G5	MD11	11		16.5	14					
		MF		11	16.5	.5	ADX	ACT		011439	1
	J6	MD11	12		9.5	2.5					
		MB		12	9.5	2	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211~~1~~943-0060 11/29/12 DM	Volume (L):	660	Scope:	04 01
Customer Sample:	HM-BG-ATV-04	Prepped By:	PK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	~~0412-ERRG-01~~ ~~ES0-002~~ 0412-ERRG-01 11/29/12 DM	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	~~0/1-3~~ 6/1-4 11/29/12 DM	Analysis Date:	11/16/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	12		none	3:1	5:1
GO Analyzed:	12				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM		Min Length:	>5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

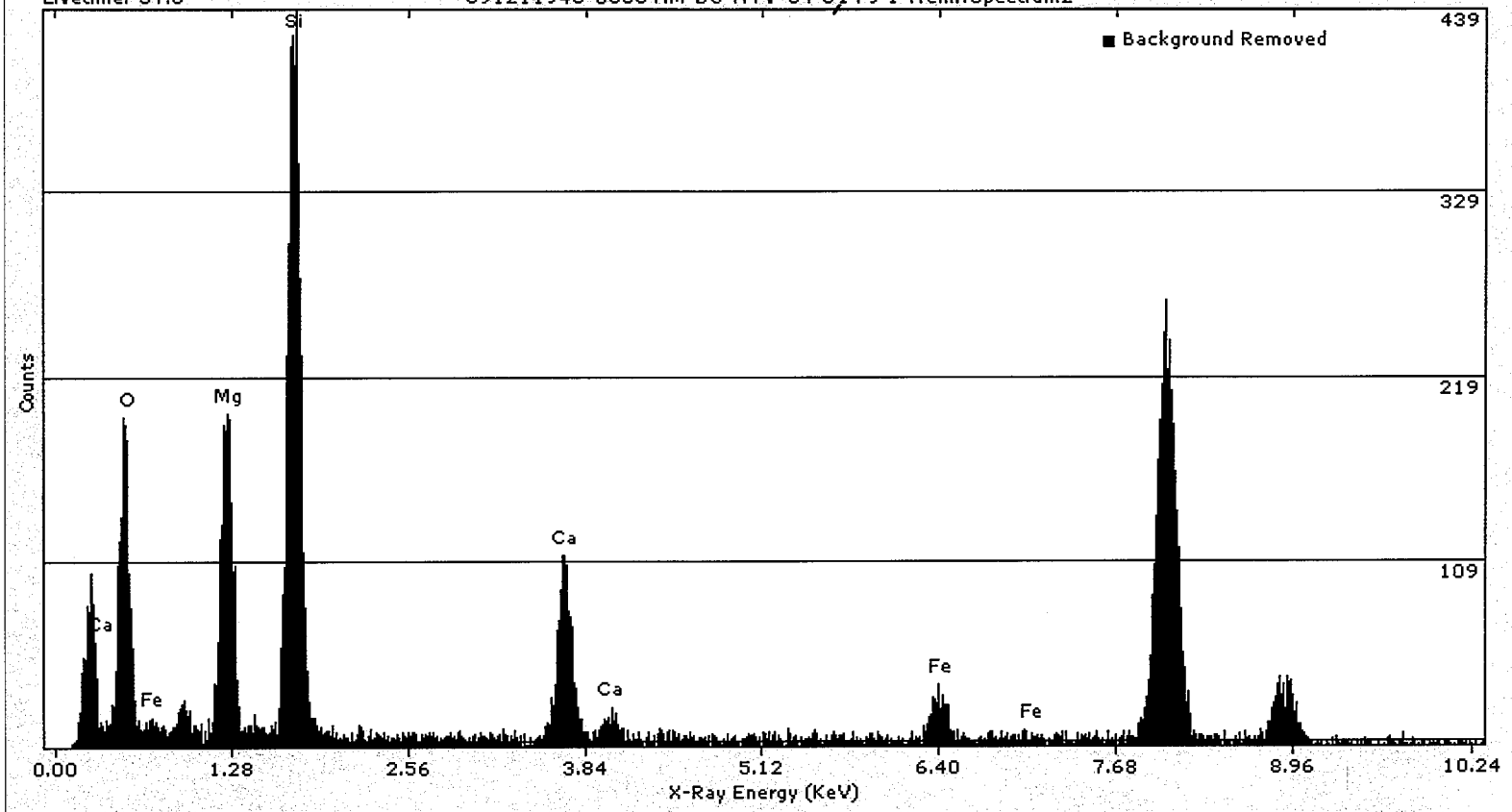
25% Particulate Loading
Vertical TD

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
L1	J6	MD22	13						13		
		MB		13	12.6	.75	CD	CH	14		
		MB		14	9.8	1.3	CD	CH			

12/4/12 DM

Realtime: 46.1
Livetime: 37.8

091211943-0060 HM-BG-ATV-04 O2 F9 1 Trem::Spectrum2



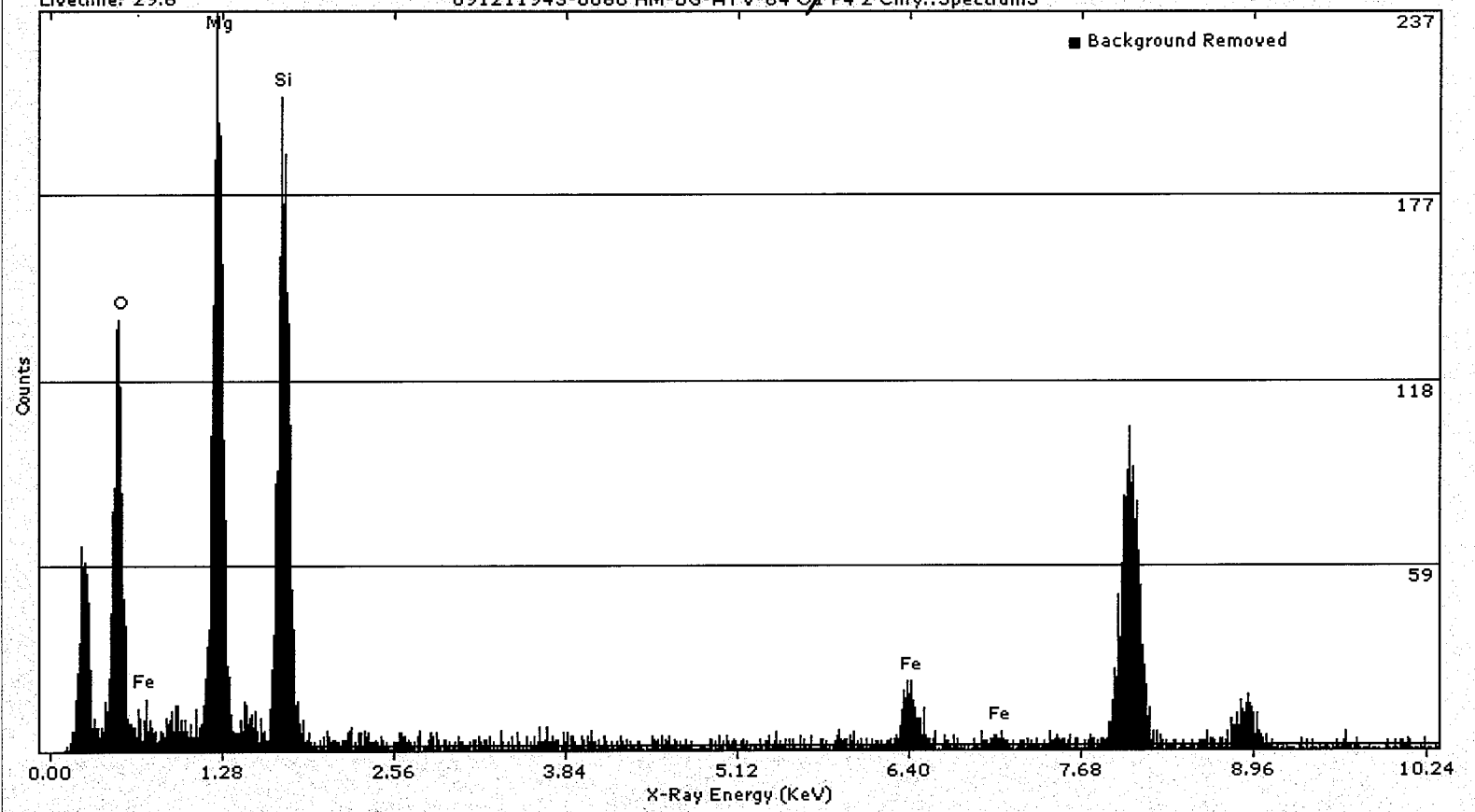
Quantitative Results for Spectrum2
Analysis: Thin Film Method: Standardless
Acquired 16-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.46	0.76	60.84	0.00		0.0000	0.0	85.8	1347.88
Magnesium	14.71	0.24	12.68	24.40	(MgO)	0.2303	1616.2	95.5	1613.57
Silicon	29.07	0.48	21.69	62.19	(SiO2)	0.4275	3724.0	101.4	3820.55
Calcium	7.65	0.13	4.00	10.71	(CaO)	0.0640	1019.4	122.1	1057.80
Iron	2.10	0.03	0.79	2.70	(FeO)	0.0175	222.3	146.1	307.42
Total	100.00			100.00					

12/4/12 OM

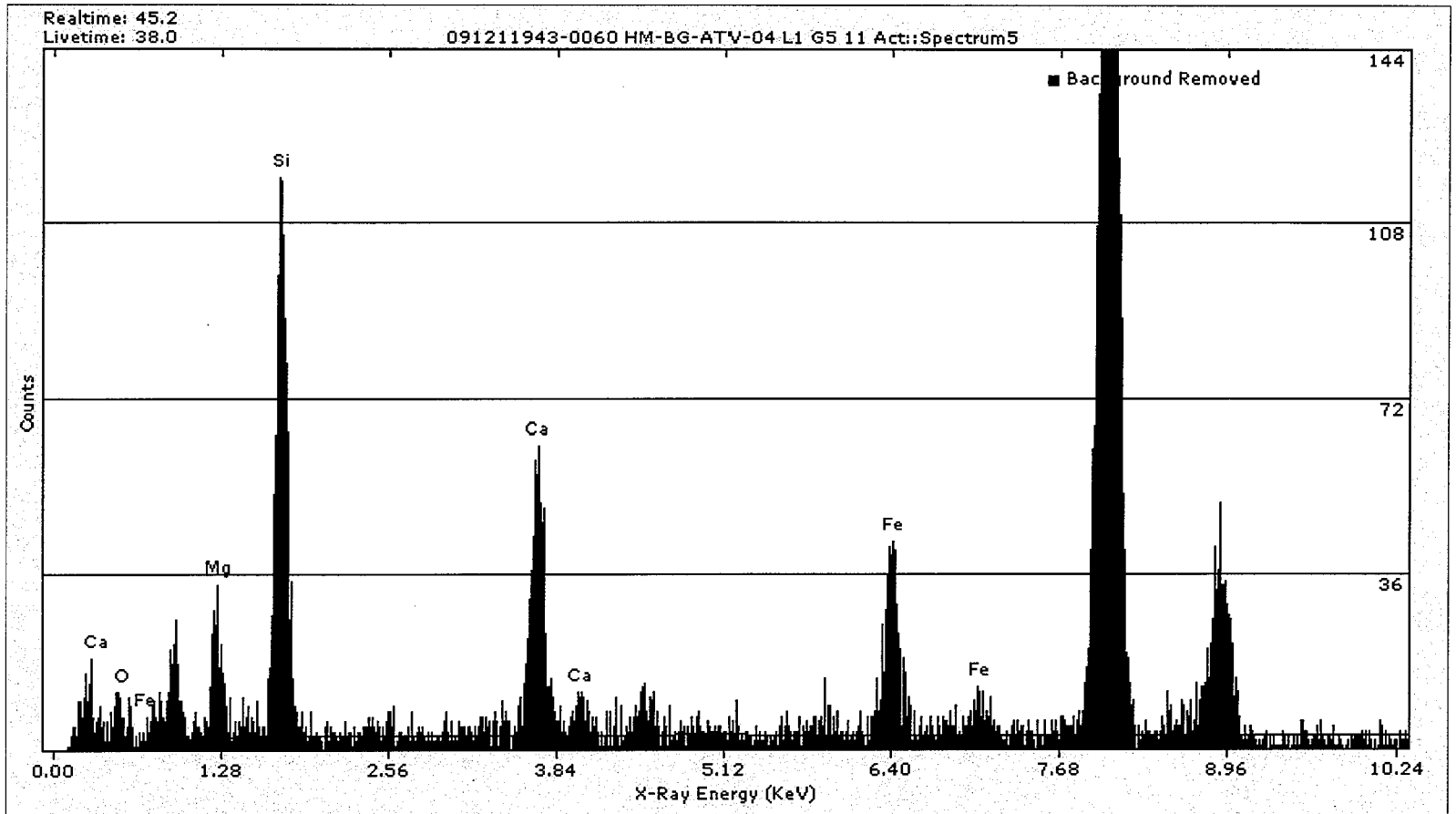
Realtime: 34.1
Livetime: 29.6

091211943-0060 HM-BG-ATV-04 O/ F4 2 Chry::Spectrum3



Quantitative Results for Spectrum3
Analysis: Thin Film Method: Standardless
Acquired 16-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	46.59	1.16	58.58	0.00		0.0000	0.0	85.8	940.07
Magnesium	29.19	0.73	24.16	48.40	(MgO)	0.3729	1620.2	95.5	1652.01
Silicon	23.96	0.60	17.16	51.26	(SiO2)	0.2890	1551.1	101.4	1603.64
Iron	0.26	0.01	0.09	0.33	(FeO)	0.0188	13.9	146.1	198.08
Total	100.00			100.00					



Quantitative Results for Spectrum5
Analysis: Thin Film Method: Standardless
Acquired 16-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	41.92	1.49	60.20	0.00		0.0000	0.0	85.9	76.15
Magnesium	6.17	0.22	5.84	10.24	(MgO)	0.0830	168.1	95.5	191.94
Silicon	24.92	0.89	20.39	53.32	(SiO2)	0.2644	791.3	101.4	932.38
Calcium	15.33	0.54	8.79	21.45	(CaO)	0.1254	506.3	122.2	568.45
Iron	11.65	0.41	4.79	14.99	(FeO)	0.0937	305.7	146.2	391.24
Total	100.00			100.00					

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 16, 2012

Image Number: 011434

Sample Number: 0060-04-01

Preliminary ID: Tremolite

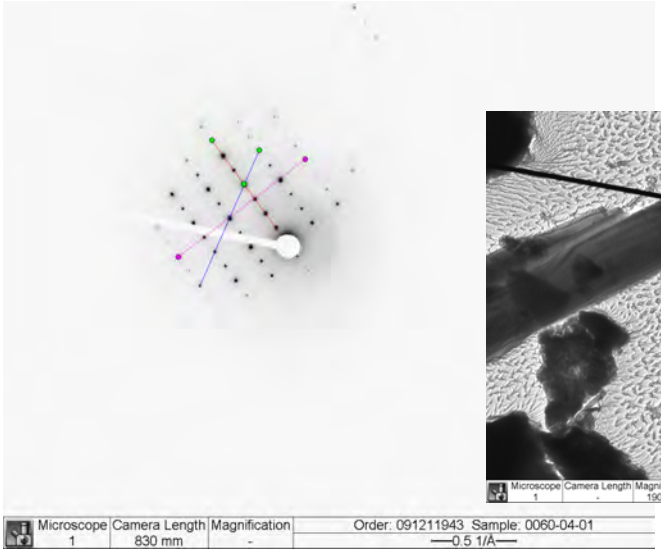
Camera Constant: 2.944e-003 **1/A Pixels**

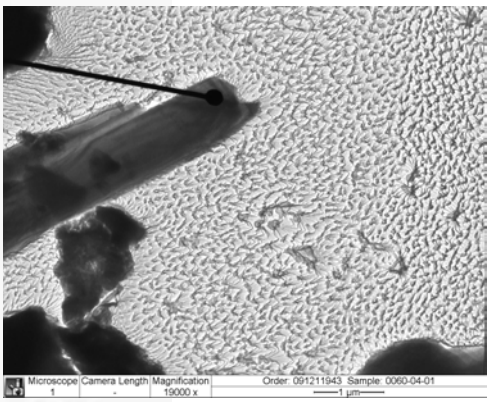
Calibration Reference: 111312.AuCal_11428

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.294**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**4.623**	4.510	**4.284**	**4.736**
d1 or hkl (Camera K/slant vector dist.):	**4.576**	4.433	**4.211**	**4.655**
Ratio of hk0/hkl:	**1.010**	1.017	**0.966**	**1.068**
Vector Angle:	**60.2**	60.620	**57.589**	**63.651**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **TREMOLITE**

With a Zone Axis of: [**1 0 0**]





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 16, 2012

Image Number: 011436

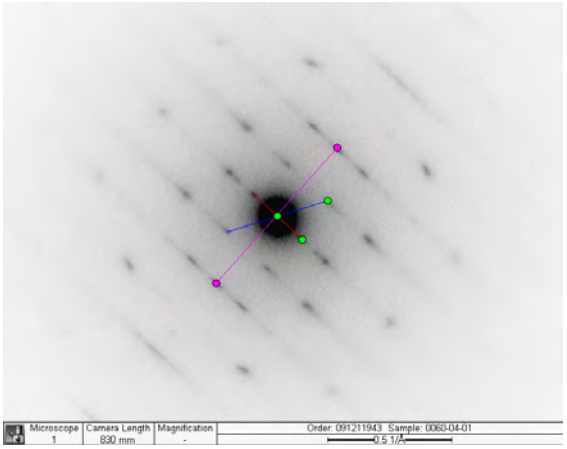
Reference / Sample Number: 0060

Preliminary ID: Chrysotile

Camera Constant: 2.944e-003 **1/A Pixels**

Calibration Reference: 111312.AuCal_11428

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.450**	5.3	**5.06**	**5.56**
Vector Angle:	**60.5**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.275**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.669**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 16, 2012

Image Number: 011439

Sample Number: 0060-04-01

Preliminary ID: Actinolite

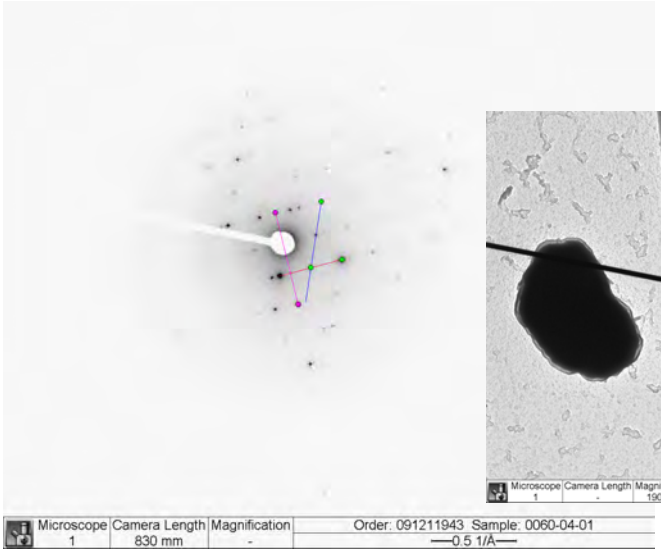
Camera Constant: 2.944e-003 **1/A Pixels**

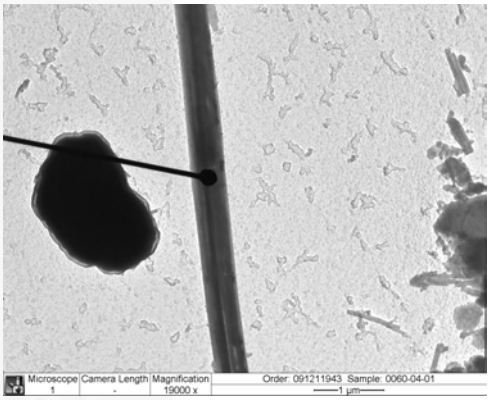
Calibration Reference: 111312.AuCal_11428

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.400**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**5.294**	5.102	**4.847**	**5.357**
d1 or hkl (Camera K/slant vector dist.):	**5.060**	4.884	**4.640**	**5.128**
Ratio of hk0/hkl:	**1.046**	1.045	**0.993**	**1.097**
Vector Angle:	**66.2**	68.030	**64.629**	**71.432**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: **[3 1 2]**





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	0912117943-0061	Volume (L):	765	Scope:	09-02
Customer Sample:	HM-BG-MB-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	L, 4-6	Analysis Date:	10/9/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	10	none	3:1	5:1	
GO Analyzed:	10				
Level of Analysis Chrysotile:	CDØ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
L4	E10	B	1	1	31	7.5	CD	CHRYS		43968	YES
L4	E8	ND									
L4	D9	ND									
L4	D7	ND									
L4	C8	ND									
L5	G1	ND									
L5	G3	ND									
L5	G5	ND									
L5	G7	ND									
L5	G9	ND									

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 091211943-0061 Client:

Client Sample:

Page 1 of 1

Primary Structure # 1	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Structure #	Structure #	Structure #	Structure #

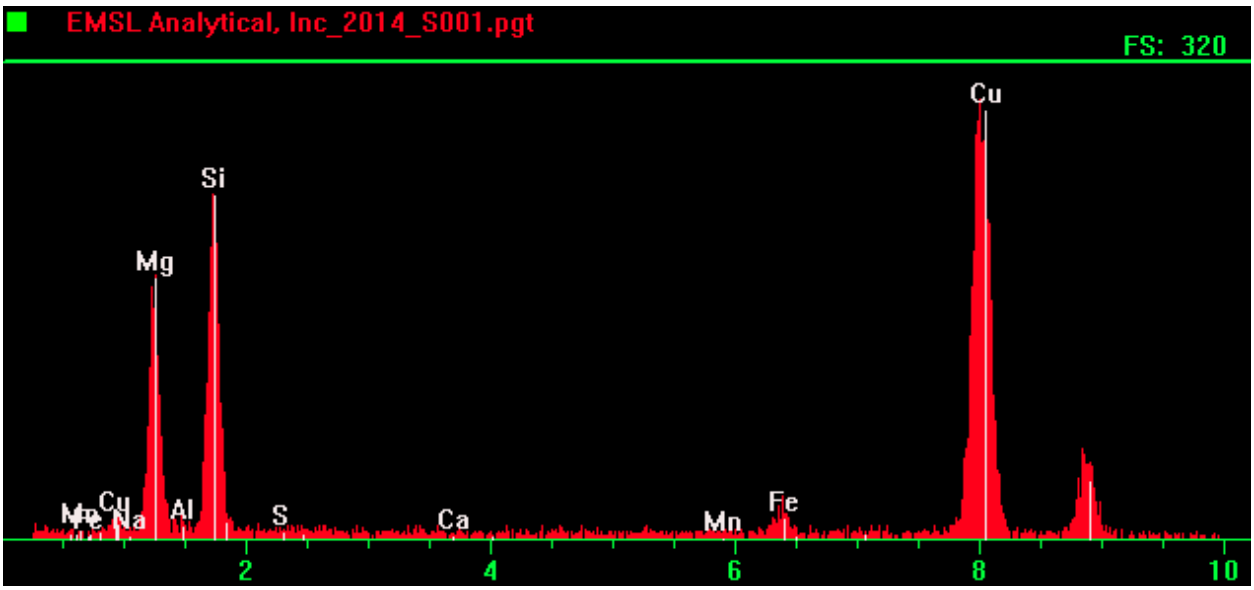
Analyst: KD Date: 9 OCT 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0061_TEM_ISO_10312_EDX_Chrysotile
Collected: October 09, 2012 16:16:15

Live Time:	41.19	Count Rate:	699	Dead Time:	8.63 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.5	3.6	0.0	0.0
Mg	KA1	76.7	4.2	72.5	17.5
Al	KA1	5.6	4.2	1.4	0.3
Si	KA1	99.6	4.4	95.2	21.6
S	KA1	3.6	3.1	0.5	0.2
Ca	KA1	3.0	2.3	0.8	0.3
Mn	KA1	3.3	2.6	0.7	0.3
Fe	KA1	11.7	2.6	9.1	3.5
Cu	KA1	208.7	2.8	205.9	72.5

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43968 SCOPE #: 2

Reference / Sample Number: 61

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.23	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

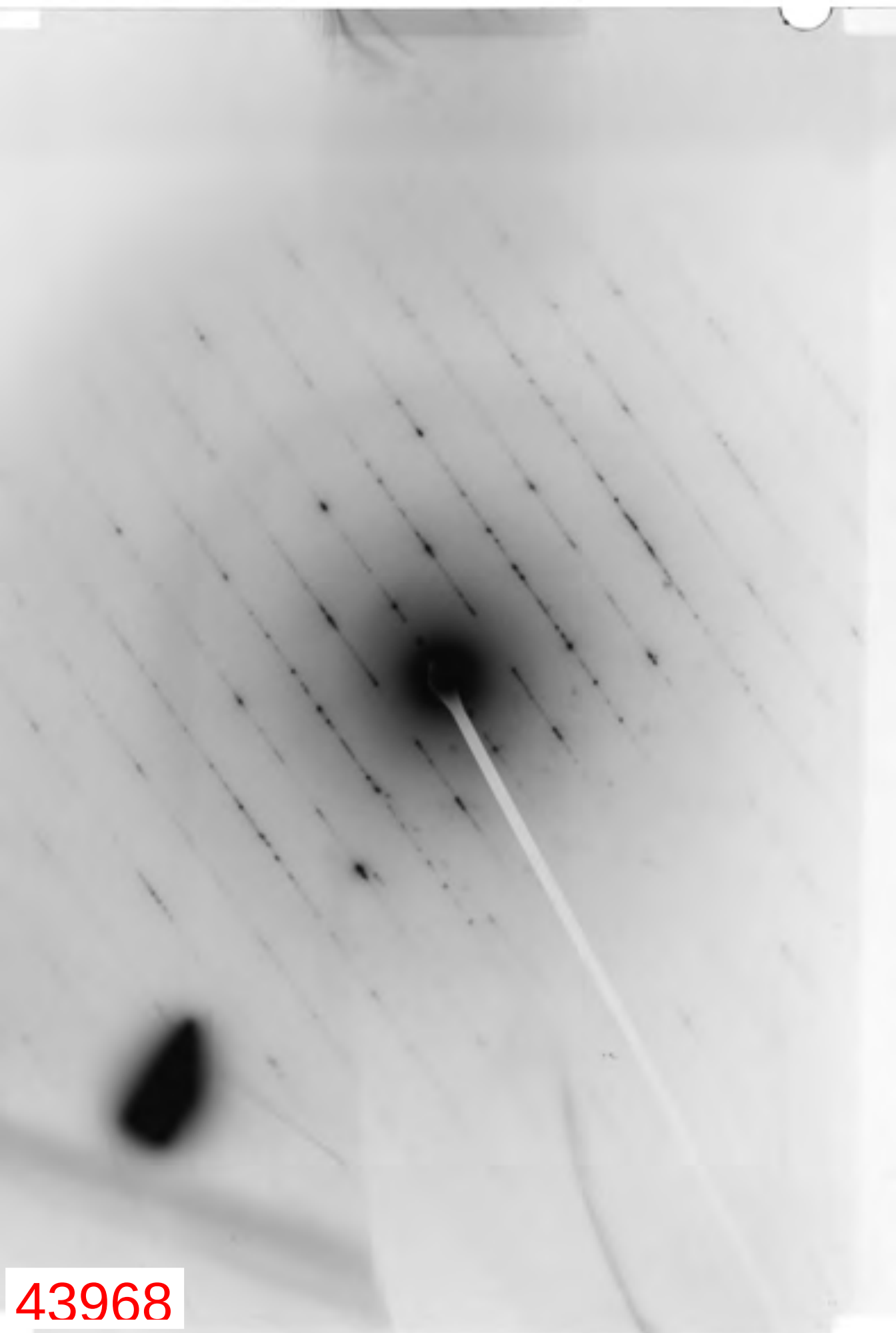
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.42**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____


43968

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211~~1~~943-0062 11/27/12 DM	Volume (L):	758	Scope:	09-02
Customer Sample:	HM-BG-MB-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	O, 4-6	Analysis Date:	10/9/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	10	none	3:1	5:1	
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD~~Q~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
O4	E5	MD11	1		6.2	1.8	CD	CHRYS			
O4	E5	MB		1	5.3	0.8	CD	CHRYS		43970	YES
O4	E5	B	2	2	9.65	0.7	CD	CHRYS			
O4	E3	B	3	3	12.1	2.1	CD	CHRYS			
O4	E3	B	4	4	11.95	1.4	ADX	ACTIN		43971	YES
O4	E1	B	5	5	26.05	5	CD	CHRYS			
O4	E1	B	6	6	7.4	1	ADX	ACTIN			
O4	D7	B	7	7	12.9	0.7	ADX	ACTIN			
O4	D7	B	8	8	14.5	2.1	ADX	ACTIN			
O5	C1	B	9	9	6.5	1.4	CD	CHRYS			

ISO 10312

091211943-0062

TEM Asbestos Count Sheet

O5	C1	B	10	10	32.3	1.1	CD	CHRYS			
O5	C1	B	11	11	10.2	1.3	CD	CHRYS			
O5	C3	B	12	12	9.8	2.2	ADX	ACTIN			
O5	C3	B	13	13	10.5	1.1	CD	CHRYS			
O5	C3	B	14	14	8.1	1.8	CD	CHRYS			
O5	C5	ND									
O6	D9	ND									
O6	D7	B	15	15	15.9	2.05	CD	CHRYS			
O6	D7	B	16	16	10.6	0.35	CD	CHRYS			
O6	D7	B	17	17	17.3	3.15	CD	CHRYS			
O6	D7	B	18	18	32.1	9.9	CD	CHRYS			
O6	D7	B	19	19	30.5	5	ADX	ACTIN			
O6	D7	B	20	20	6.1	1.4	CD	CHRYS			
O6	D5	B	21	21	8.6	2.3	ADX	ACTIN			
O6	D5	B	22	22	16.15	4.5	CD	CHRYS			
O6	D5	B	23	23	9	0.55	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

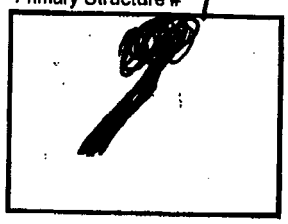
TEM ISO 10312

Structure Sketch Sheet

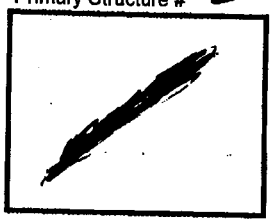
EMSL Order ID: 091211943-0062 Client:

Client Sample: _____ Page 1 of 2

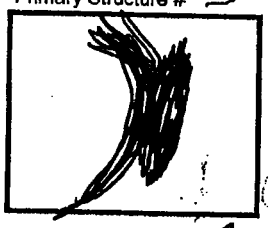
Primary Structure # 1



Primary Structure # 2



Primary Structure # 3



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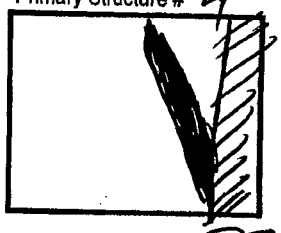
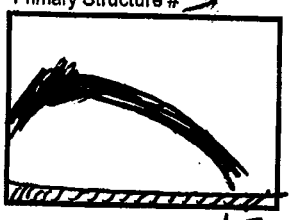
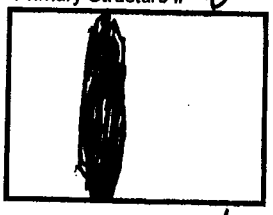


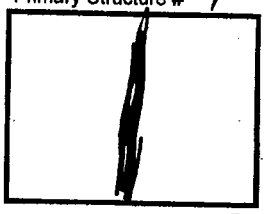
Primary Structure # 5



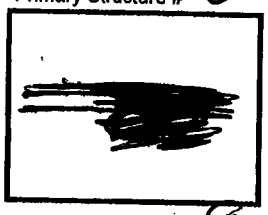
Primary Structure # 6



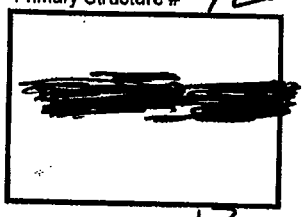
Primary Structure # 7



Primary Structure # 8



Primary Structure # 12



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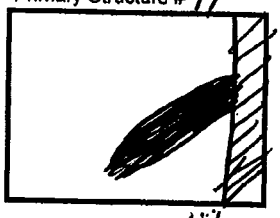
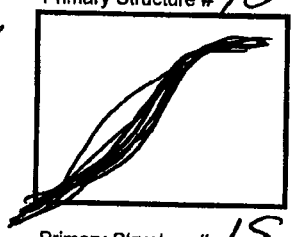


Primary Structure # 10



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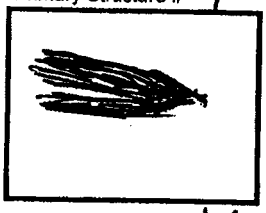
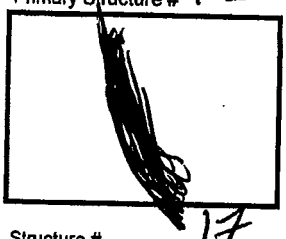


Primary Structure # 13



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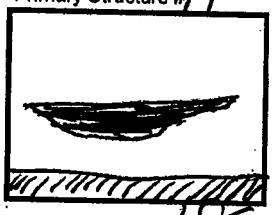

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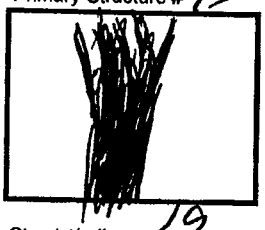

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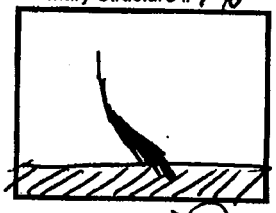
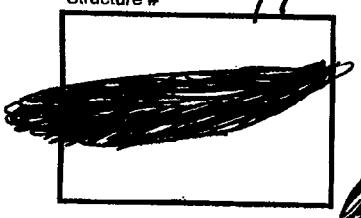


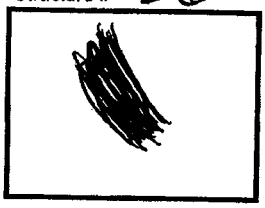
Structure # 17



Structure # 18

Structure # 19

Structure # 20



Analyst: KD Date: 9OCT12 Scope: 2

TEM ISO 10312

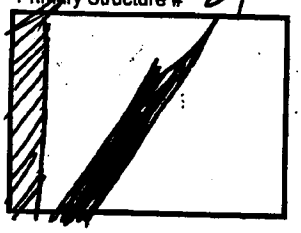
Structure Sketch Sheet

EMSL Order ID: 091211943-0062 **Client:**

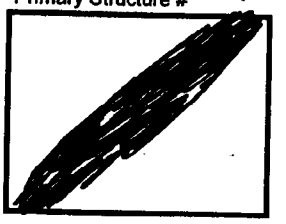
Client Sample:

Page 2 of 2

Primary Structure # 21



Primary Structure # 22



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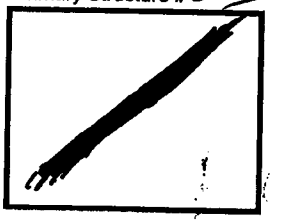

Primary Structure #

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Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

Analyst: KD

Date: 9OCT12

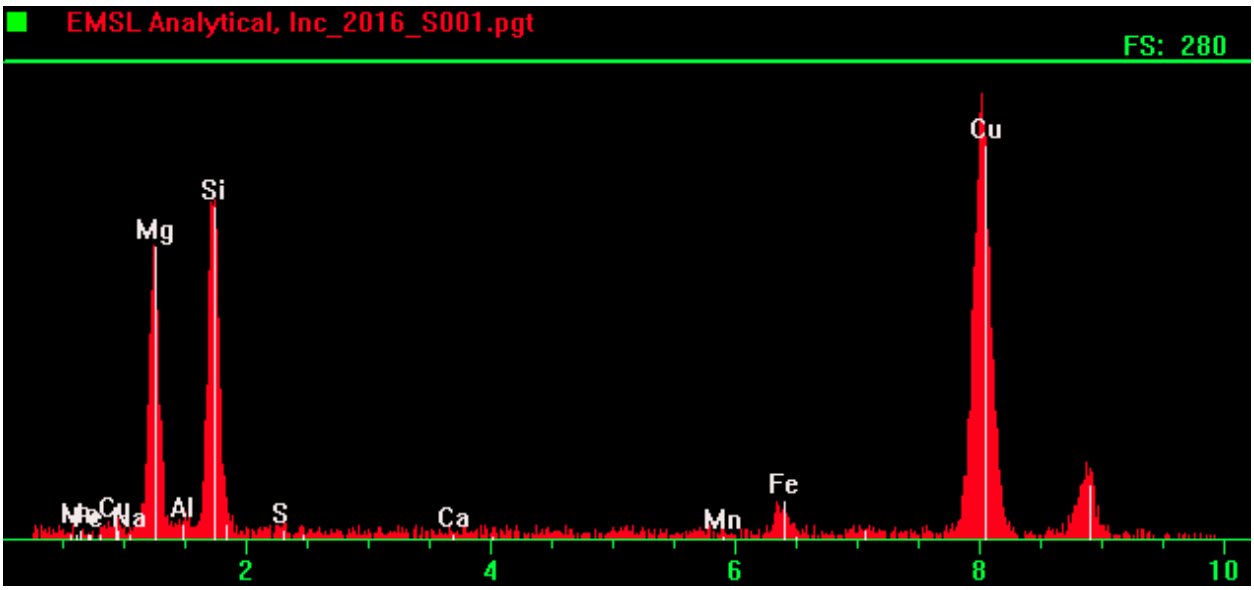
Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0062_TEM_ISO_10312_EDX_Chrysotile
Collected: October 09, 2012 17:12:10

Live Time:	51.30	Count Rate:	494	Dead Time:	6.59 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



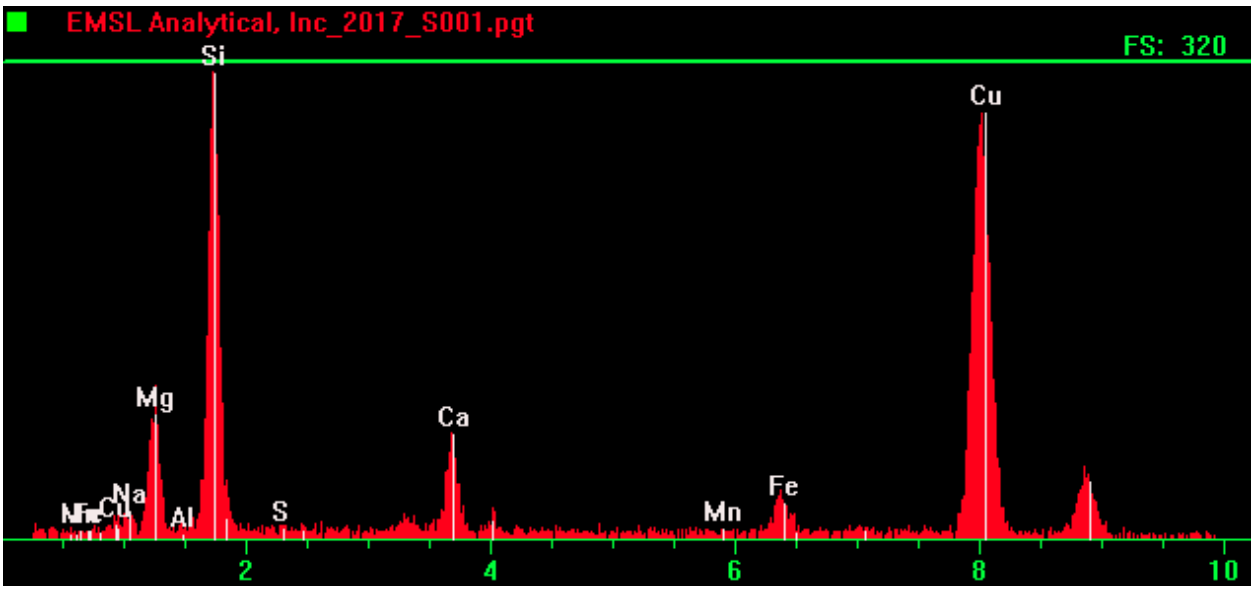
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	2.4	1.9	0.2	0.1
Mg	KA1	58.4	2.3	56.1	24.0
Al	KA1	4.4	2.4	1.9	0.8
Si	KA1	76.8	2.6	74.2	28.4
S	KA1	2.9	1.6	1.3	0.8
Ca	KA1	2.3	1.7	0.6	0.4
Mn	KA1	2.3	2.2	0.1	0.0
Fe	KA1	9.7	2.1	7.6	3.6
Cu	KA1	142.3	2.3	140.0	61.4

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0062_TEM_ISO_10312_EDX_Actinolite
Collected: October 09, 2012 17:27:06

Live Time:	37.99	Count Rate:	844	Dead Time:	10.23 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	7.9	3.9	3.6	0.9
Mg	KA1	43.3	3.8	39.5	10.4
Al	KA1	4.4	3.9	0.4	0.1
Si	KA1	155.4	4.1	151.3	36.8
S	KA1	3.8	4.3	0.0	0.0
Ca	KA1	38.2	4.9	33.3	6.8
Mn	KA1	4.2	3.1	1.1	0.3
Fe	KA1	21.9	3.8	18.0	4.8
Cu	KA1	220.8	4.1	216.7	52.8

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43970 SCOPE #: 2

Reference / Sample Number: 62

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

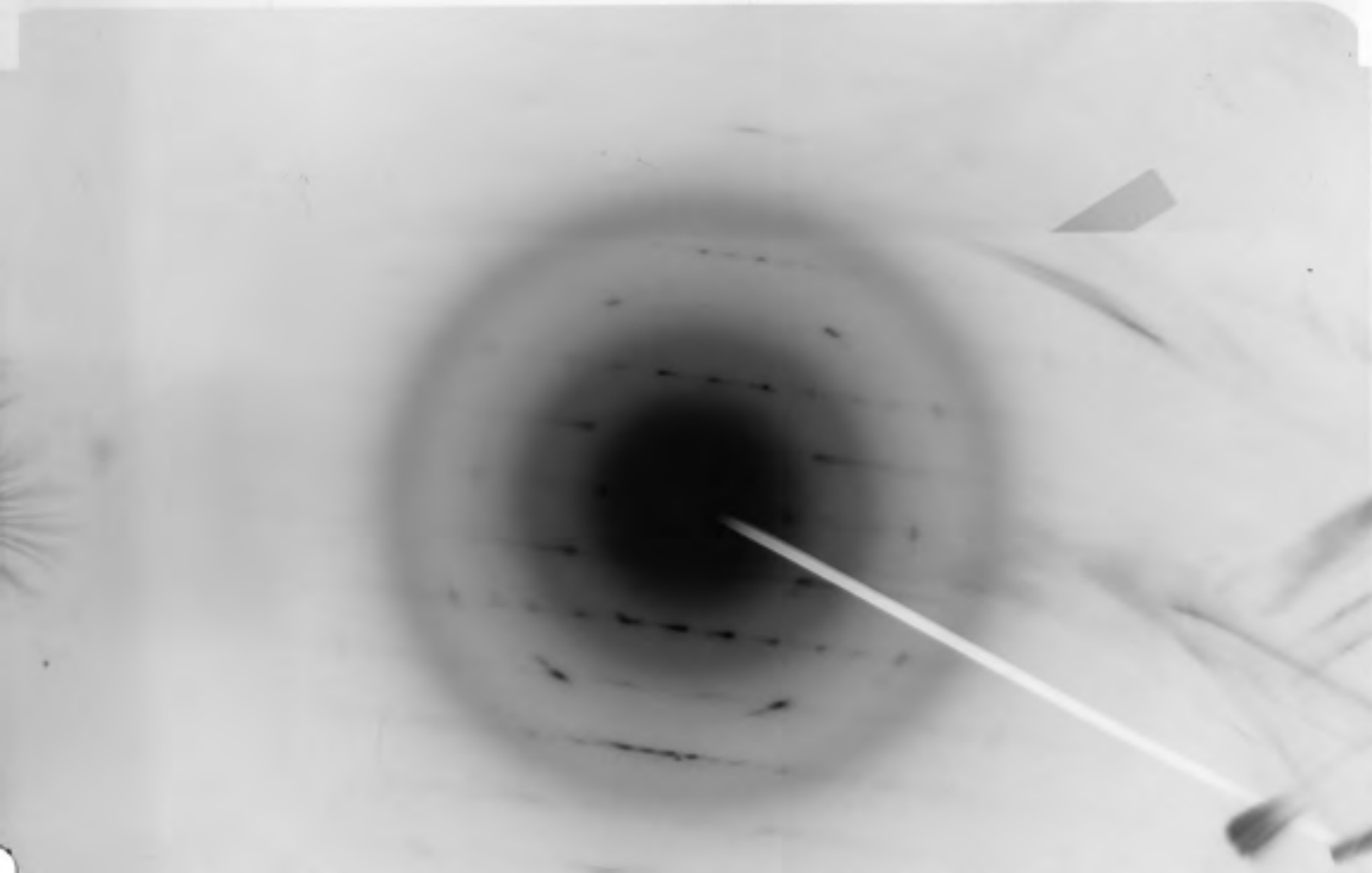
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9843910



AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43971 SCOPE # 2

Reference / Sample Number: 62

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.51 mm
Mean Distance between spots on Center row (d2): 2.9 mm
Mean distance between spots on slant vector (d1): 5 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.30**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**8.24**	8.429	**8.008**	**8.850**
d1 or hk1 (Camera K/slant vector dist.)	**4.78**	4.931	**4.684**	**5.178**
Ratio of hk0/hk1	**1.72**	1.71	**1.625**	**1.796**
Angle of Slant Vector (Measured)	67.0	68.5	**65.075**	**71.925**

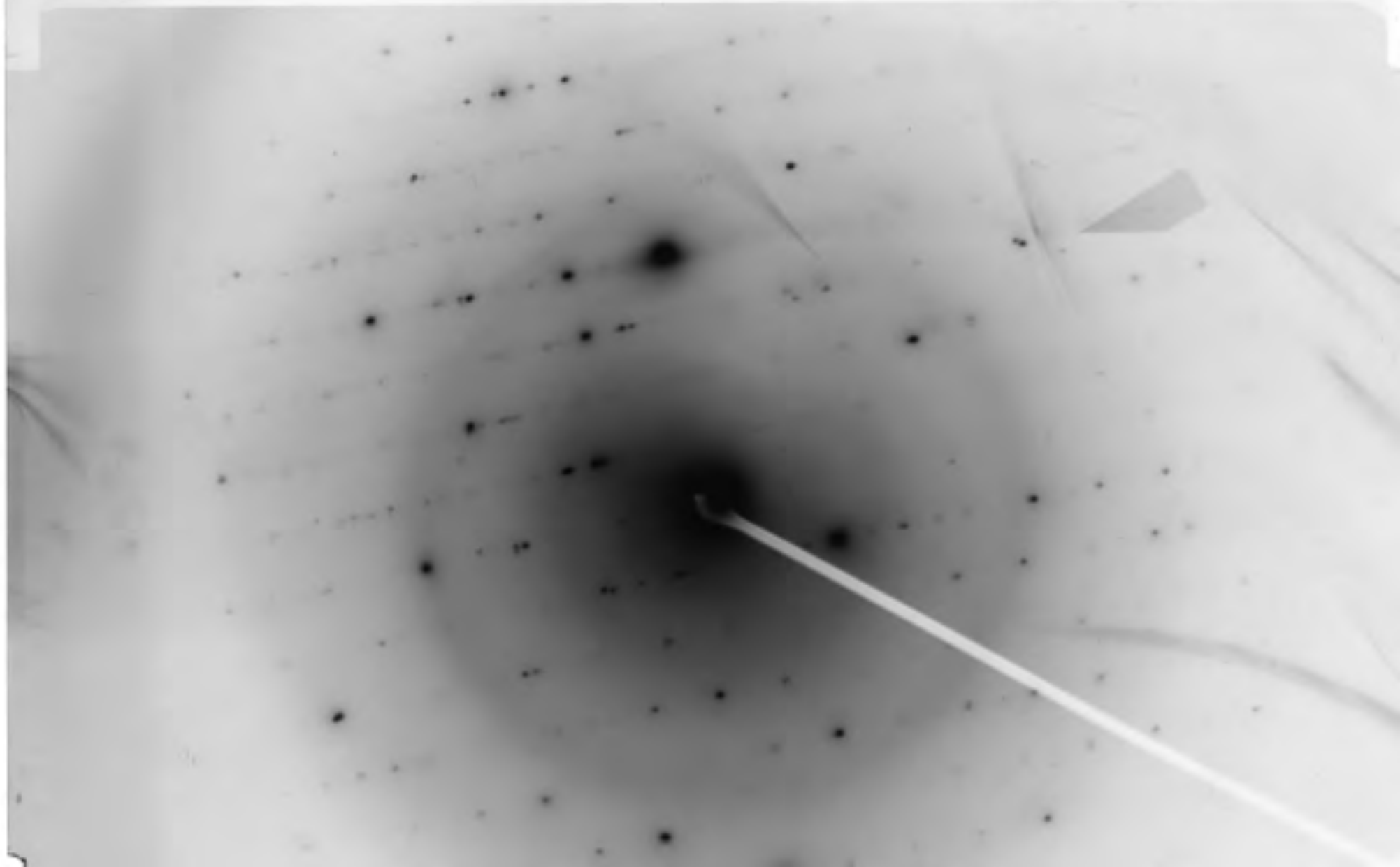
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [1 1 0]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

1043971



ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	091211~~1~~943-0063	Volume (L):	693	Scope:	09-02
Customer Sample:	HM-BG-MB-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	P, 1-3	Analysis Date:	10/10/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
P1	C8	ND									
P1	C6	MD11	1		7.9	1.2	CDQ	CHRYS			
P1	C6	MB		1	7.9	0.6	CDQ	CHRYS		43972	YES
P1	C4	ND									
P1	C2	ND									
P2	H1	ND									
P2	H3	ND									
P2	H5	ND									
P3	F1	ND									
P3	F3	ND									
P3	F5	MD11	2		10.9	3.1	CD	CHRYS			
P3	F5	MB		2	10.9	0.7	CD	CHRYS			
P3	F7	ND									

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 091211943-0063 Client:

Client Sample:

Page 1 of 1

Primary Structure # 1	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Structure #	Structure #	Structure #	Structure #

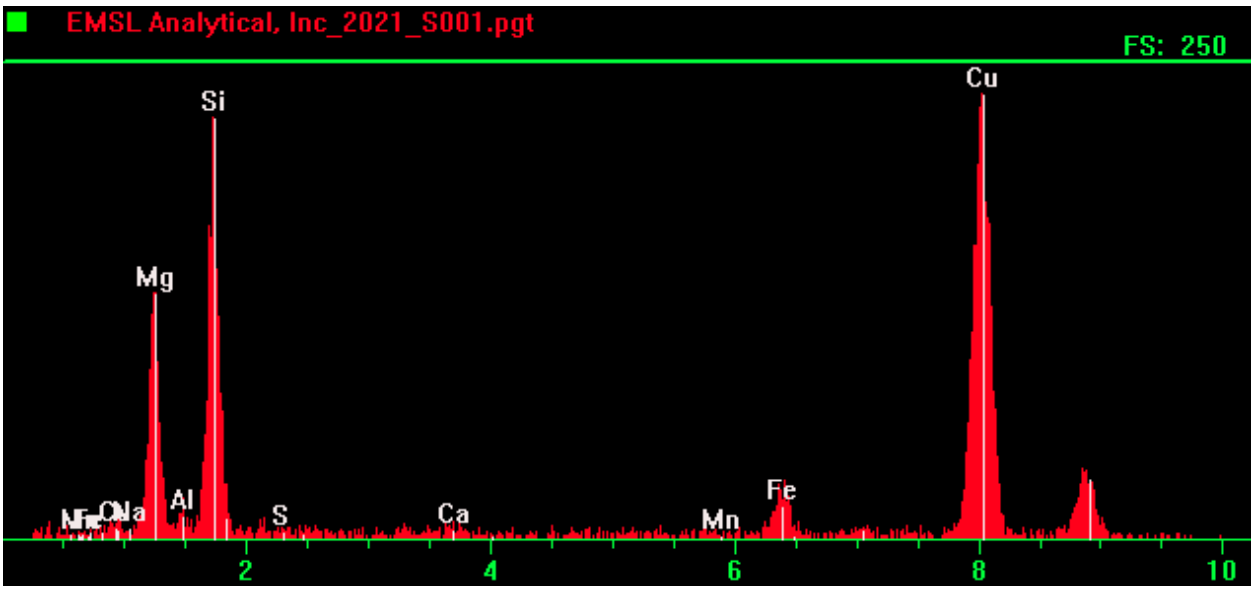
Analyst: KD Date: 10SEPT12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0063_TEM_ISO_10312_EDX_Chrysotile
Collected: October 10, 2012 11:55:57

Live Time:	65.56	Count Rate:	341	Dead Time:	4.54 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	1.5	1.8	0.0	0.0
Mg	KA1	33.6	2.1	31.5	15.1
Al	KA1	4.0	2.2	1.8	0.8
Si	KA1	54.0	2.0	52.0	26.2
S	KA1	1.6	1.3	0.3	0.3
Ca	KA1	2.3	0.9	1.4	1.6
Mn	KA1	1.4	1.1	0.3	0.3
Fe	KA1	10.9	1.1	9.8	8.9
Cu	KA1	97.4	1.8	95.6	53.6

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43972 SCOPE #: 2

Reference / Sample Number: 63

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

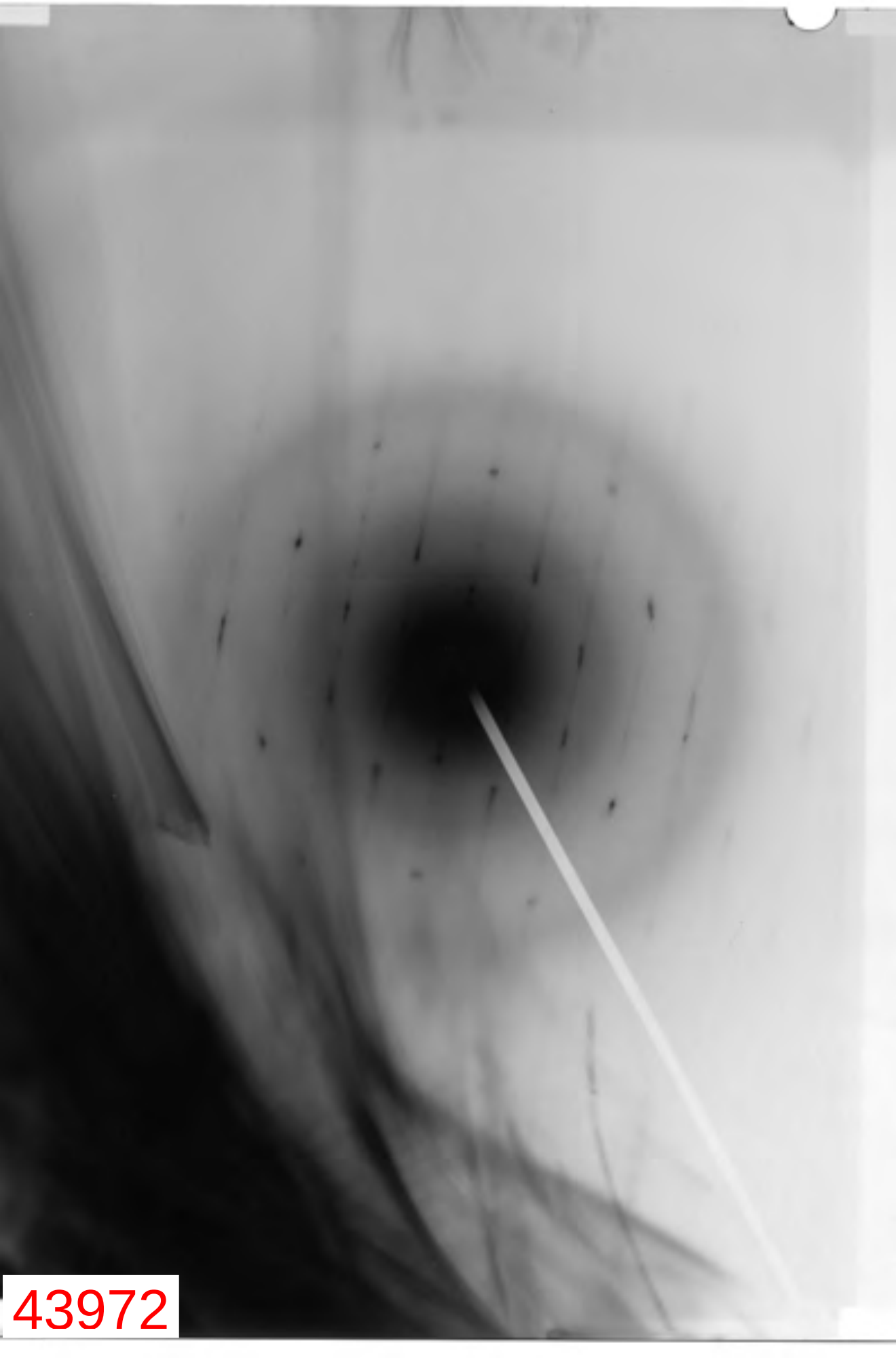
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43972

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211~~1~~943-0064 11/27/12 DM	Volume (L):	684	Scope:	09-02
Customer Sample:	HM-BG-MB-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	P, 4-6	Analysis Date:	10/10/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 DM	Min Length:	≥ 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
P4	I1	B	1	1	12.8	2.8	CD	CHRYS		44002	
P4	I3	B	2	2	6.8	1.4	CD	CHRYS			YES
P4	I5	B	3	3	6	1.3	CD	CHRYS			
P4	I5	B	4	4	9.6	3.1	CD	CHRYS			
P4	I5	B	5	5	11.9	1.1	CD	CHRYS			
P4	I7	B	6	6	15.6	3.8	CD	CHRYS			
P4	I7	B	7	7	16.5	2.4	CD	CHRYS			
P4	I7	B	8	8	18.8	3.8	CD	CHRYS			
P4	I7	B	9	9	45.6	3.8	CD	CHRYS			
P5	E6	B	10	10	17.1	1.3	CD	CHRYS			

ISO 10312

TEM Asbestos Count Sheet

P5	E8	ND									
P5	E10	B	11	11	13.4	2.1	CD	CHRYS			
P6	C5	B	12	12	7.8	1.6	CD	CHRYS			
P6	C3	MD11	13		29.2	25	CD	CHRYS			
P6	C3	MB		13	16.8	2.1	CD	CHRYS			
P6	C1	B	14	14	15.1	3.8	CD	CHRYS			
P6	C1	MD11	15		22.1	5.8	CD	CHRYS			
P6	C1	MB		15	22.1	0.4	CD	CHRYS			
P6	C1	B	16	16	9.2	1.6	CD	CHRYS			
P6	I10	ND									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

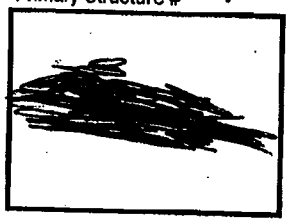
Structure Sketch Sheet

EMSL Order ID: 091211943-0064 Client:

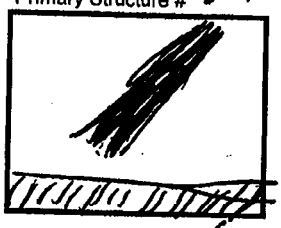
Client Sample:

Page 1 of 1

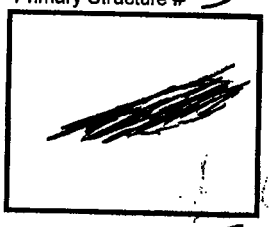
Primary Structure # 1



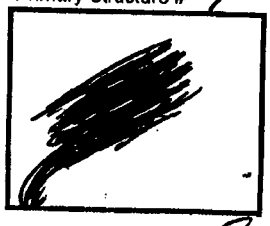
Primary Structure # 2



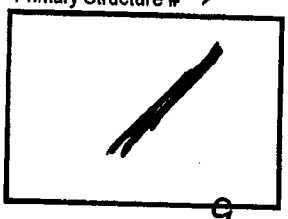
Primary Structure # 3



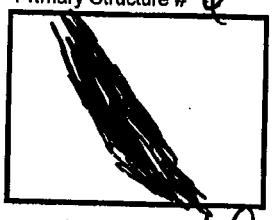
Primary Structure # 4



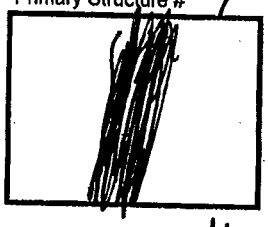
Primary Structure # 5



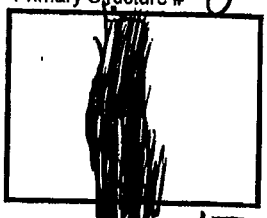
Primary Structure # 6



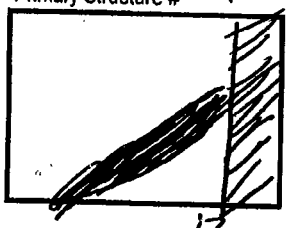
Primary Structure # 7



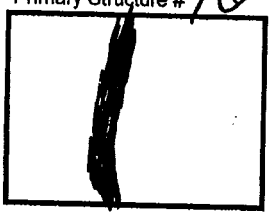
Primary Structure # 8



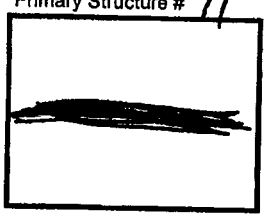
Primary Structure # 9



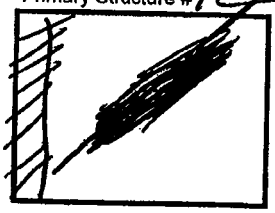
Primary Structure # 10



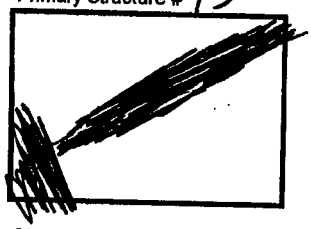
Primary Structure # 11



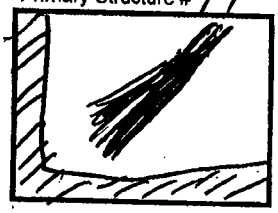
Primary Structure # 12



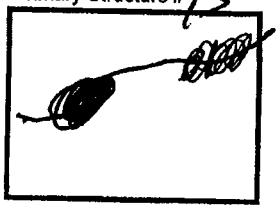
Primary Structure # 13



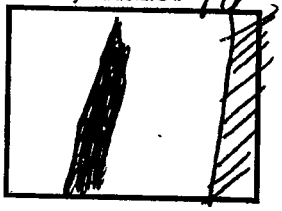
Primary Structure # 14



Primary Structure # 15



Primary Structure # 16



Structure #

Structure #

Structure #

Structure #

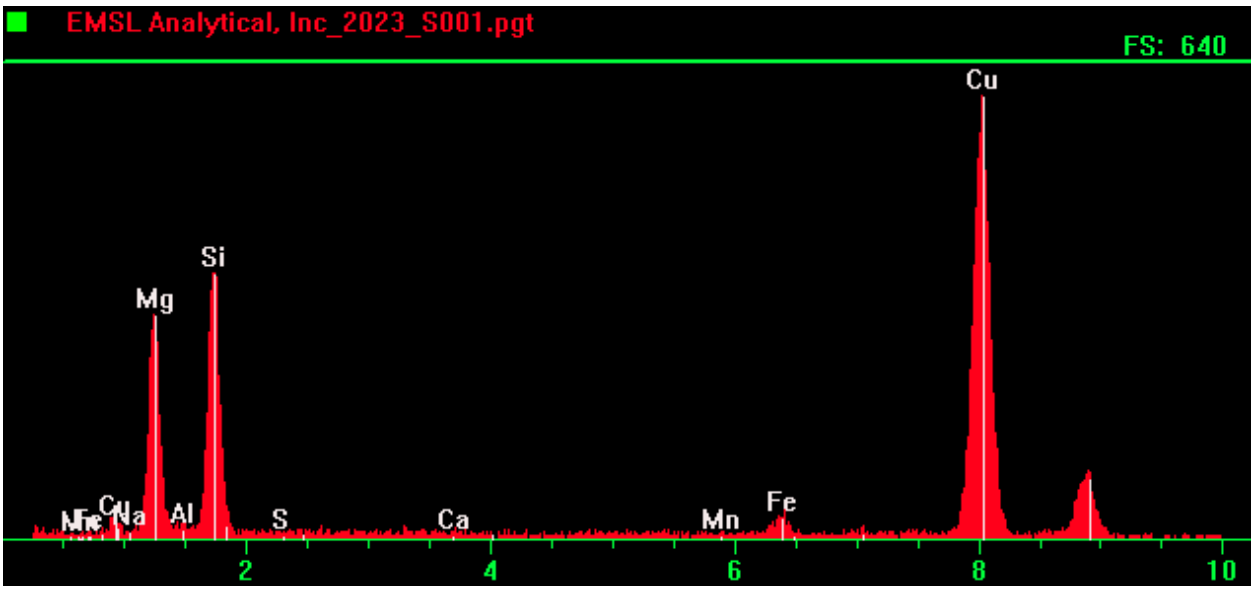
Analyst: KD Date: 100CT12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0064_TEM_ISO_10312_EDX_Chrysotile
Collected: October 10, 2012 12:17:12

Live Time:	76.40	Count Rate:	679	Dead Time:	8.23 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.0	2.4	0.0	0.0
Mg	KA1	70.9	2.6	68.3	26.0
Al	KA1	5.6	2.8	2.8	1.0
Si	KA1	93.4	2.9	90.5	30.7
S	KA1	2.9	2.8	0.1	0.1
Ca	KA1	2.8	2.4	0.4	0.2
Mn	KA1	3.1	2.7	0.3	0.1
Fe	KA1	10.9	2.8	8.0	2.8
Cu	KA1	217.2	2.9	214.2	72.7

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 44002 SCOPE #: 2

Reference / Sample Number: 64

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.45 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

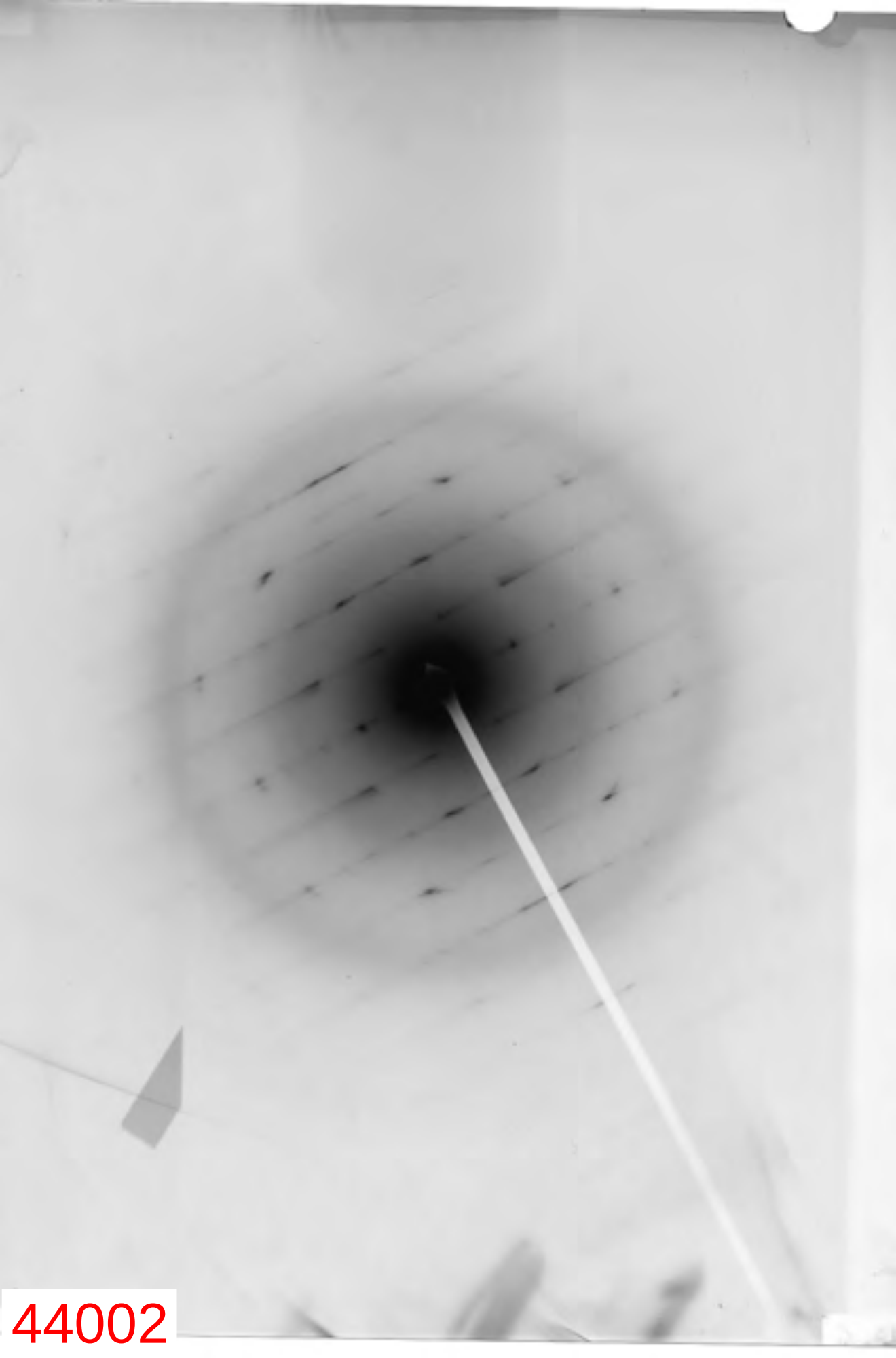
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.38**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



44002

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211/943-0065 11/27/12 DMM	Volume (L):	733	Scope:	09-02
Customer Sample:	HM-BG-HK-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	Q, 1-3	Analysis Date:	10/10/125

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CDQ 11/27/12 DMM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
Q1	F1	ND									
Q1	F3	B	1	1	6.8	1	ADX	ACTIN		43974	YES
Q1	F3	B	2	2	9.4	1.15	ADX	ACTIN			
Q1	F5	ND									
Q1	F7	B	3	3	6	0.25	CDQ	CHRYS		43976	YES
Q2	F1	ND									
Q2	F3	ND									
Q2	F5	B	4	4	7.8	1.8	CD	CHRYS			
Q2	F7	ND									
Q3	F1	ND									
Q3	F3	ND									
Q3	F5	ND									

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312

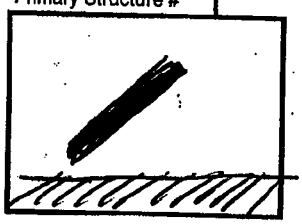
Structure Sketch Sheet

EMSL Order ID: 0912119413-0065 **Client:**

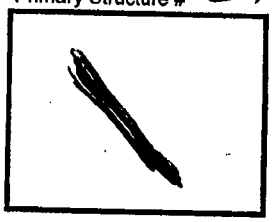
Client Sample:

Page 1 of 1

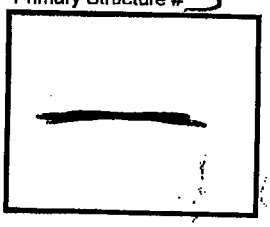
Primary Structure # 1



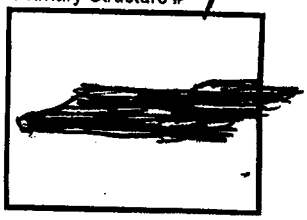
Primary Structure # 2



Primary Structure # 3



Primary Structure # 4



Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

Analyst: KD

Date: 100CT12

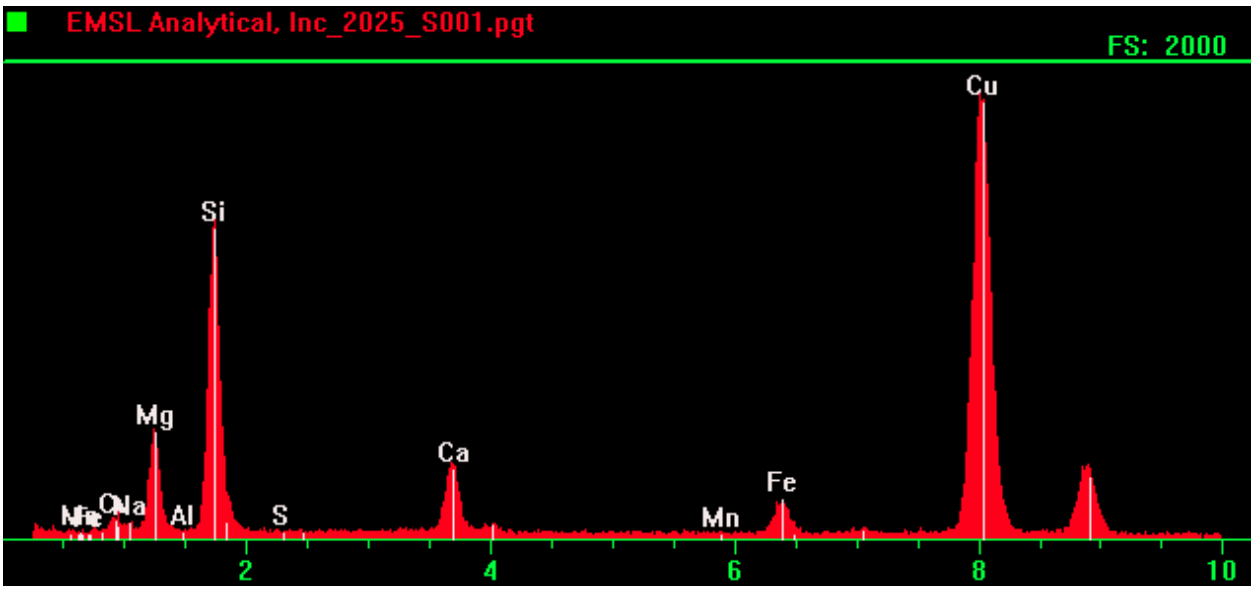
Scope: E

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0065_TEM_ISO_10312_EDX_Actinolite
Collected: October 10, 2012 13:34:14

Live Time:	75.59	Count Rate:	2458	Dead Time:	27.80 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



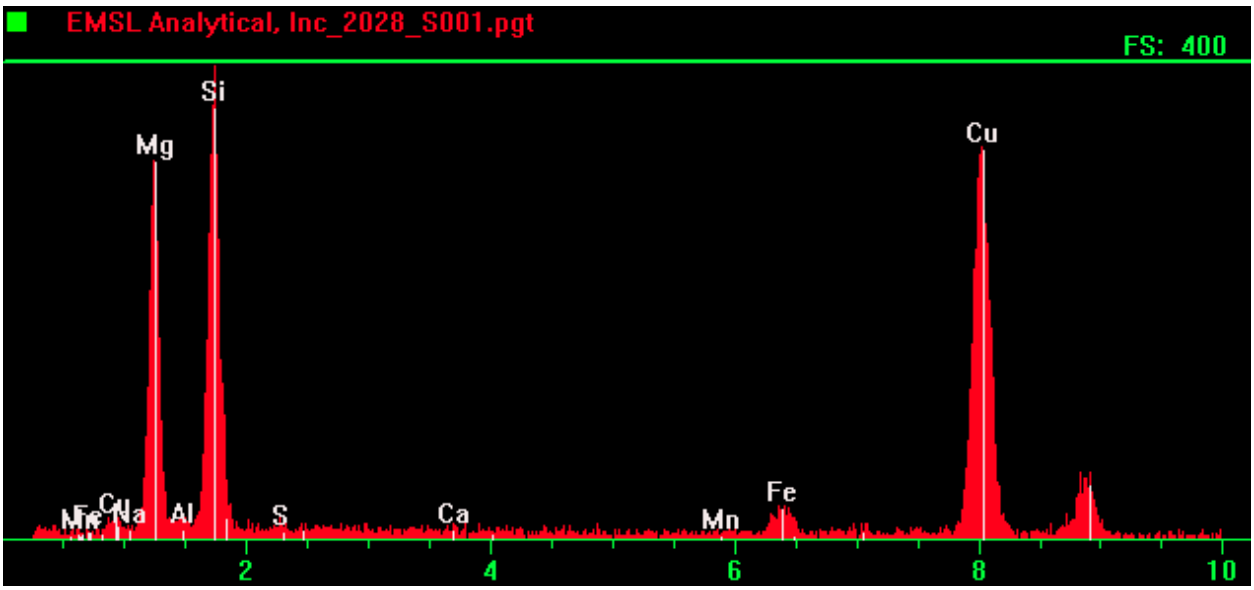
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	18.7	10.8	6.0	0.6
Mg	KA1	103.6	12.3	91.4	7.5
Al	KA1	11.8	12.7	0.0	0.0
Si	KA1	334.9	12.9	322.0	24.9
S	KA1	10.9	11.6	0.0	0.0
Ca	KA1	96.2	12.7	83.5	6.6
Mn	KA1	10.7	10.6	0.1	0.0
Fe	KA1	56.3	11.0	45.3	4.1
Cu	KA1	740.8	13.7	727.1	52.9

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0065_TEM_ISO_10312_EDX_Chrysotile
Collected: October 10, 2012 13:58:42

Live Time:	66.34	Count Rate:	599	Dead Time:	7.26 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.5	2.3	0.8	0.3
Mg	KA1	80.1	2.5	77.5	30.6
Al	KA1	5.7	2.9	2.8	1.0
Si	KA1	107.6	3.0	104.6	34.7
S	KA1	3.7	3.1	0.6	0.2
Ca	KA1	3.3	2.7	0.6	0.2
Mn	KA1	2.8	2.1	0.7	0.3
Fe	KA1	12.8	2.2	10.6	4.9
Cu	KA1	140.7	2.4	138.4	58.8

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43974 SCOPE # 2

Reference / Sample Number: 65

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.6 mm
Mean Distance between spots on Center row (d2): 5 mm
Mean distance between spots on slant vector (d1): 4.8 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.19**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**4.78**	4.762	**4.524**	**5.000**
d1 or hk1 (Camera K/slant vector dist.)	**4.98**	4.931	**4.684**	**5.178**
Ratio of hk0/hk1	**0.96**	97.00	**92.150**	**101.850**
Angle of Slant Vector (Measured)	71.0	74.0	**70.300**	**77.700**

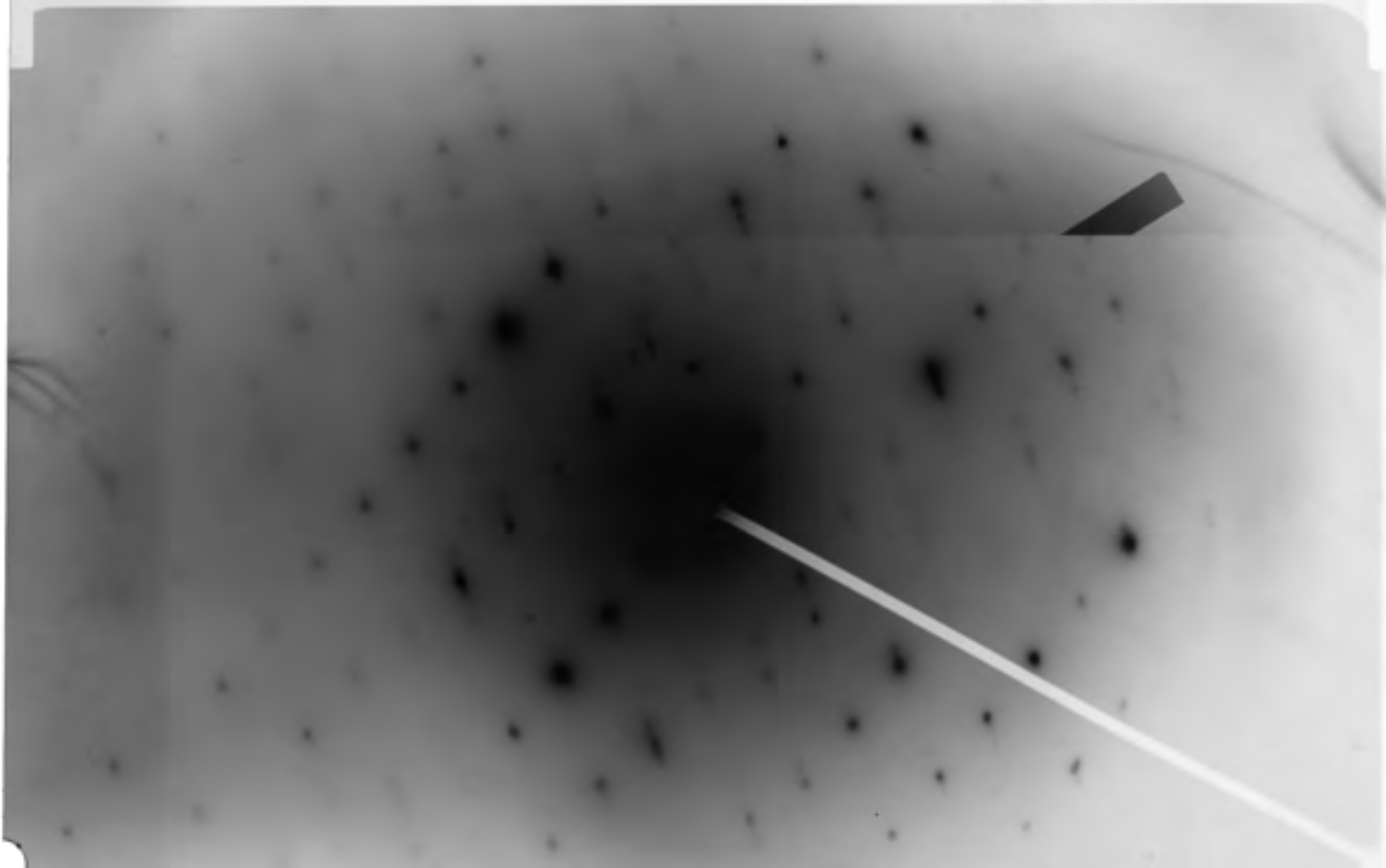
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [0 1 -1]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9843974



EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43976 SCOPE #: 2

Reference / Sample Number: 65

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.45 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

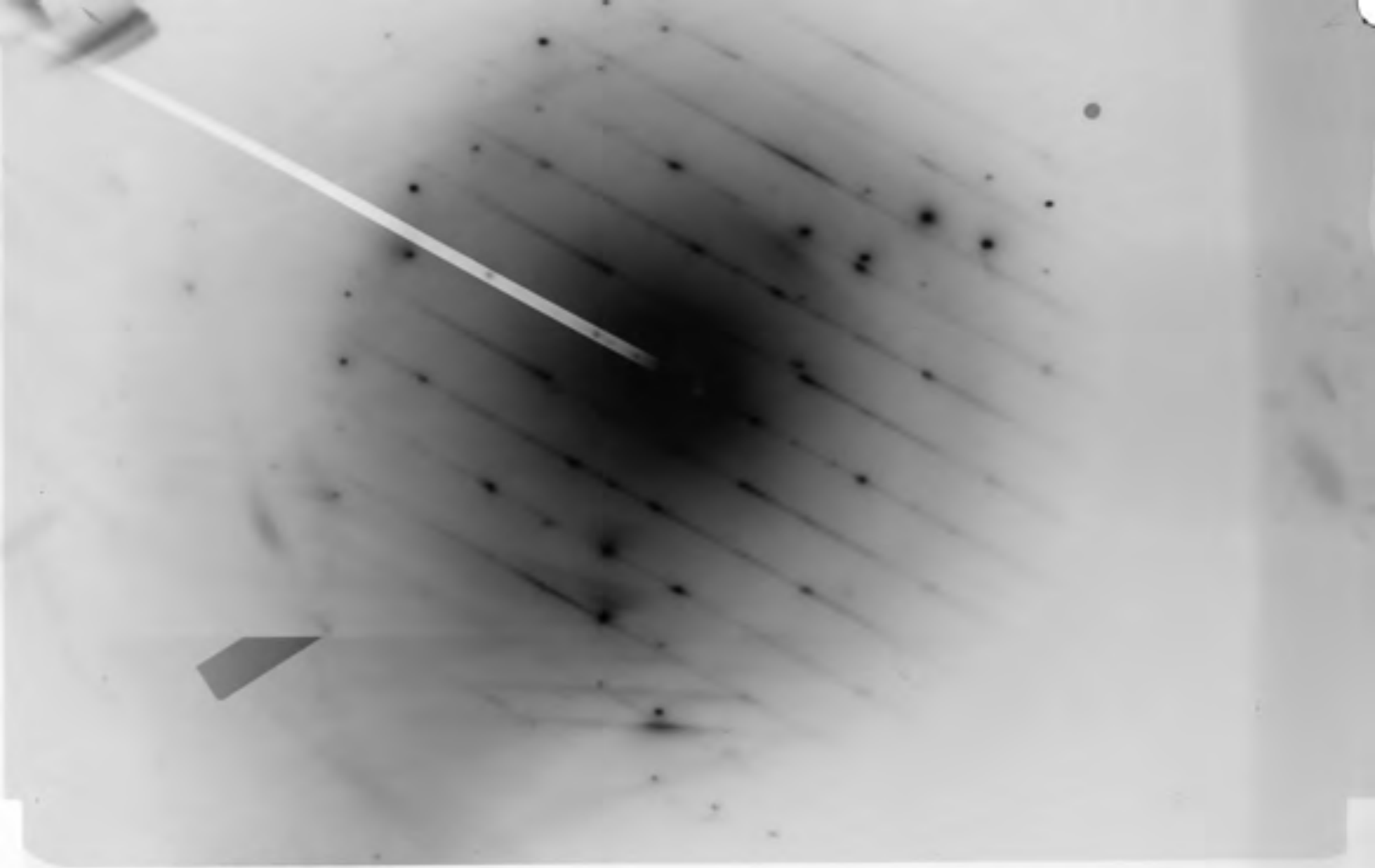
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.38**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	63	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



9843916

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0066 11/27/12 DM	Volume (L):	810	Scope:	OQ-O 2
Customer Sample:	HM-BG-HK-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	Q, 4-6	Analysis Date:	10/10/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	10	none	3:1	5:1	
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD~~Q~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.~~3~~5 2 11/27/12 DM	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
Q4	F1	ND									
Q4	F3	ND									
Q4	F5	ND									
Q4	F7	ND									
Q5	F1	ND									
Q5	F3	B	1	1	10.2	1.8	CDQ	CHRYS		43979	YES
Q5	F3	B	2	2	8.8	1.5	CD	CHRYS			
Q5	F5	B	3	3	6.55	1.6	CD	CHRYS			
Q6	E6	B	4	4	10.1	1.25	CD	CHRYS			
Q6	E4	ND									
Q6	E2	ND									

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312

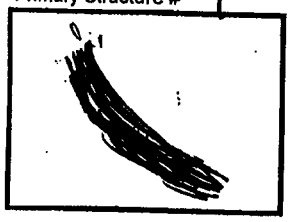
Structure Sketch Sheet

EMSL Order ID: 091211943-0066 Client:

Client Sample:

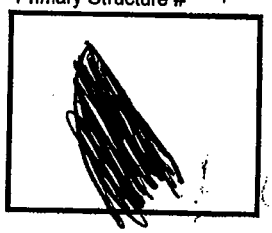
Page 1 of 1

Primary Structure # 1

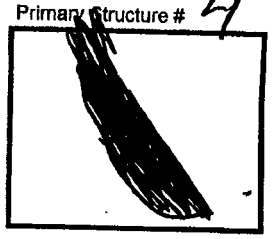


Primary Structure # 2

Primary Structure # 3



Primary Structure # 4



Primary Structure #

Primary Structure #

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Primary Structure #

Structure #

Structure #

Structure #

Structure #

Analyst: KD

Date: 10/28/12

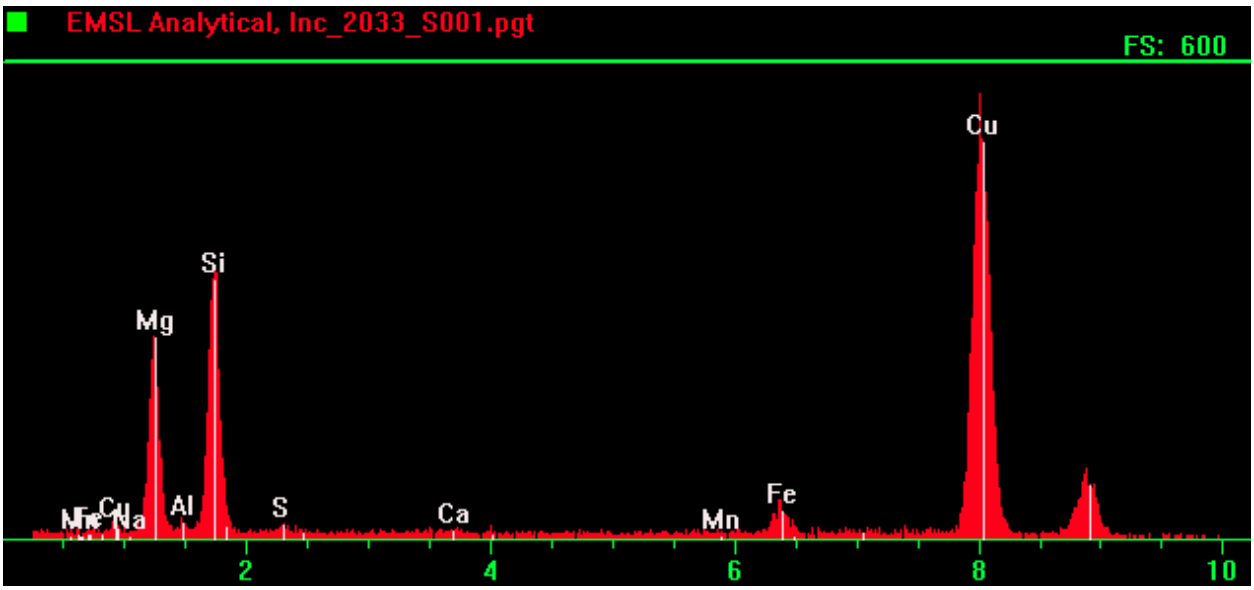
Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0066_TEM_ISO_10312_EDX_Chrysotile
Collected: October 10, 2012 14:35:57

Live Time:	78.65	Count Rate:	608	Dead Time:	7.75 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	2.5	2.4	0.0	0.0
Mg	KA1	57.9	2.6	55.2	20.9
Al	KA1	5.0	2.7	2.3	0.8
Si	KA1	80.6	2.9	77.8	27.2
S	KA1	4.7	2.6	2.0	0.8
Ca	KA1	3.4	2.3	1.1	0.5
Mn	KA1	3.1	2.2	0.9	0.4
Fe	KA1	13.1	2.7	10.3	3.7
Cu	KA1	193.0	3.0	190.0	63.0

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43979 SCOPE #: 2

Reference / Sample Number: 66

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.45 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

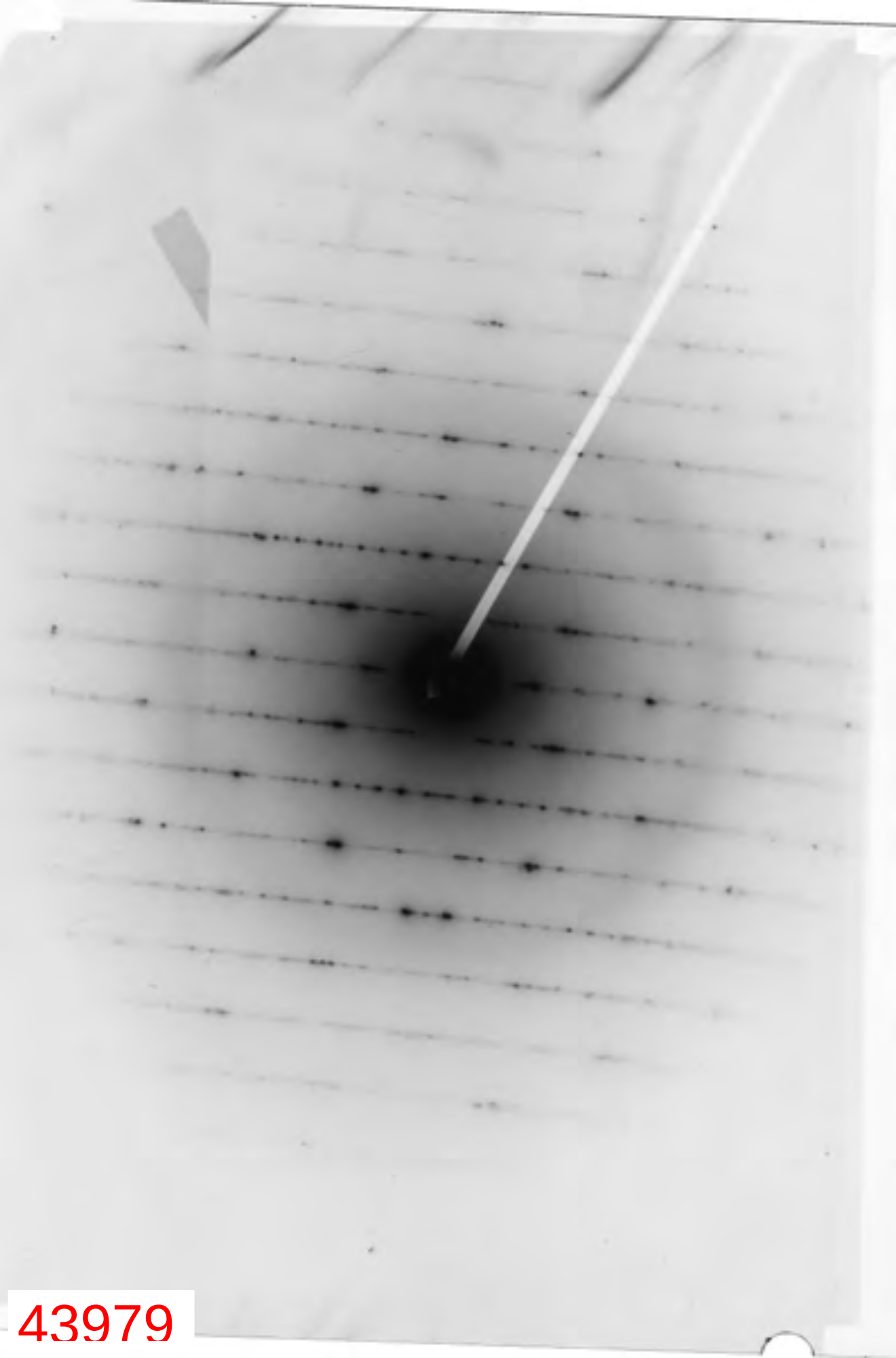
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.38**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43979

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0067 11/27/12 DM	Volume (L):	724	Scope:	09-02
Customer Sample:	HM-BG-HK-013 11/27/12 DM	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	R, 1-3	Analysis Date:	10/10/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	11		none	3:1	5:1
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
R1	C9	B	1	1	12.5	1.5	ADX	ACTIN		43991	YES
R1	C9	B	2	2	16.6	2.8	CD	CHRYS		43981	YES
R1	C7	B	3	3	6.6	1.3	CD	CHRYS			
R1	C7	B	4	4	6.4	1.4	ADX	ACTIN			
R1	C7	MD11	5		13	13.8	ADX	ACTIN			
R1	C7	MB		5	7.4	1.2	ADX	ACTIN			
R1	C7	B	6	6	14.1	4.2	ADX	ACTIN			
R1	C7	B	7	7	5.8	1.6	CD	CHRYS			
R1	C5	B	8	8	17.2	5	CD	CHRYS			
R1	C5	B	9	9	14.3	2.8	CD	CHRYS			

091211943-0067

ISO 10312

TEM Asbestos Count Sheet

R1	C3	B	10	10	6.9	0.8	CD	CHRYS			
R2	I9	B	11	11	7.1	0.98	CD	CHRYS			
R2	I7	ND									
R2	I5	B	12	12	11.4	1.8	CD	CHRYS			
R2	I5	B	13	13	10.1	1.1	CD	CHRYS			
R2	I3	ND									
R3	E6	B	14	14	9.95	1.25	CD	CHRYS			
R3	E4	B	15	15	7.4	1.2	ADX	ACTIN			
R3	E4	MD11	16		13.1	10	ADX	ACTIN			
R3	E4	MB		16	6.8	0.8	ADX	ACTIN			
R3	E2	B	17	17	21.2	6.3	CD	CHRYS			
R3	E2	B	18	18	12.1	2.2	CD	CHRYS			
R3	E2	B	19	19	16.1	5.1	CD	CHRYS			
R3	E2	B	20	20	9.1	0.7	CD	CHRYS			
R3	E2	B	21	21	39.4	4.2	CD	CHRYS			
R3	E2	MD11	22		8.8	4.4	CD	CHRYS			
R3	E2	MB		22	5.1	1.6	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

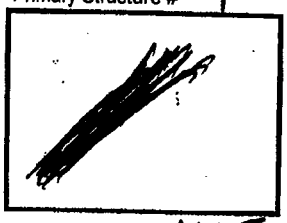
TEM ISO 10312

Structure Sketch Sheet

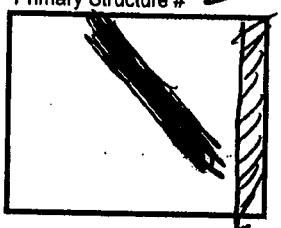
EMSL Order ID: 091211943-0067 **Client:**

Client Sample: _____ Page 1 of 2

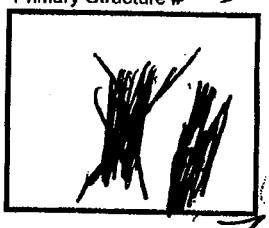
Primary Structure # 1



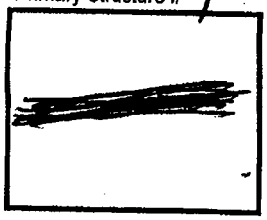
Primary Structure # 2



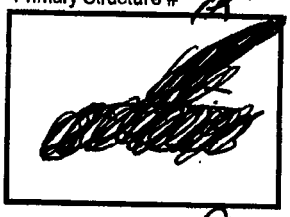
Primary Structure # 3



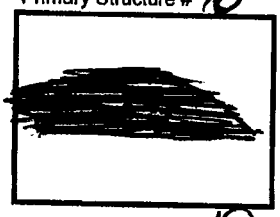
Primary Structure # 4



Primary Structure # 5



Primary Structure # 6



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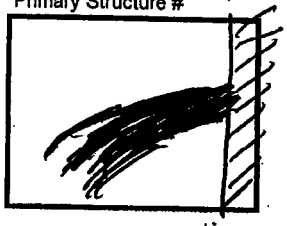
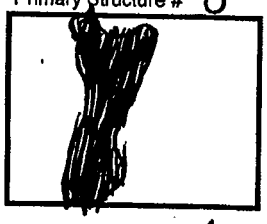
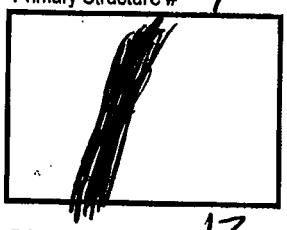


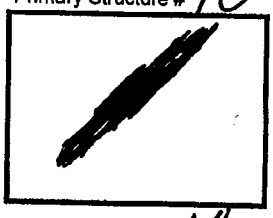
Primary Structure # 8



Primary Structure # 9



Primary Structure # 10



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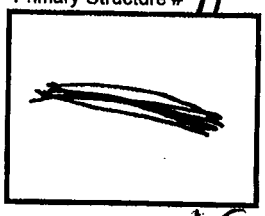
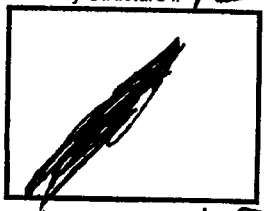
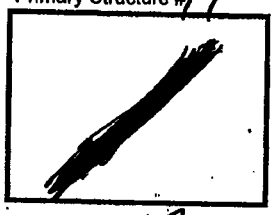


Primary Structure # 12



Primary Structure # 13

Primary Structure # 14



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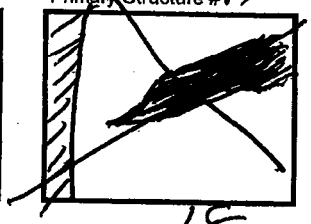

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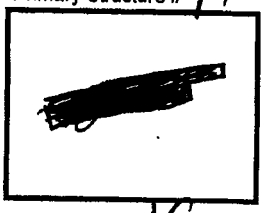
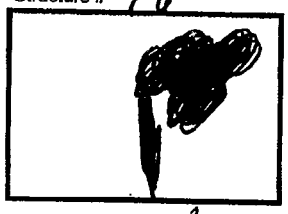
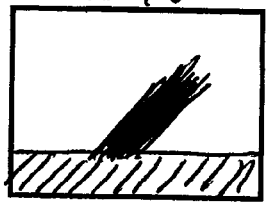


Structure # 16



Structure # 17

Structure # 18



Structure # 19

Analyst: KD Date: 10 Oct 12 Scope: Z

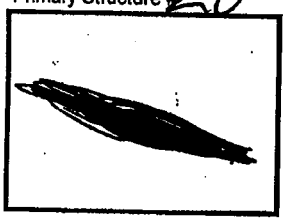
TEM ISO 10312

Structure Sketch Sheet

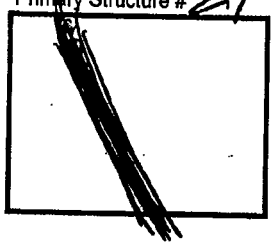
EMSL Order ID: 091211943-0067 Client:

Client Sample: _____ Page 2 of 2

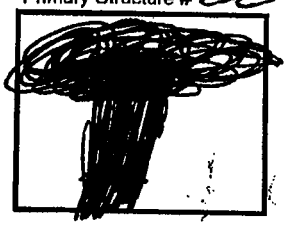
Primary Structure # 20



Primary Structure # 21



Primary Structure # 22



Primary Structure #

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Structure #

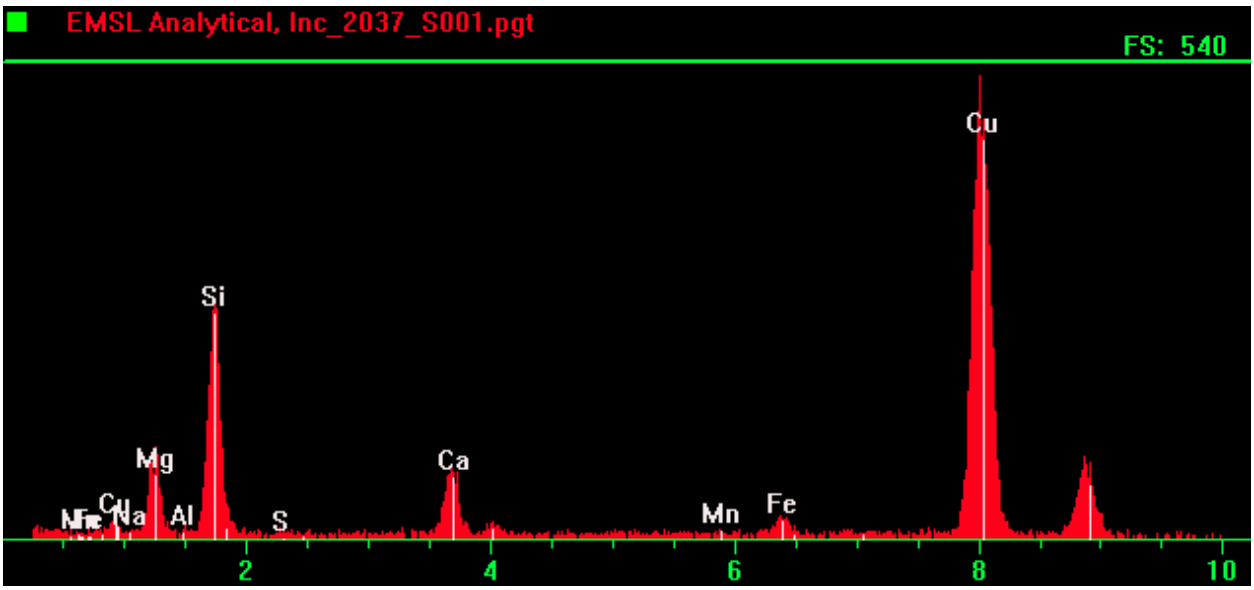
Analyst: KD Date: 10 OCT 12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0067_TEM_ISO_10312_EDX_Actinolite
Collected: October 10, 2012 16:15:47

Live Time:	41.42	Count Rate:	1031	Dead Time:	12.89 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



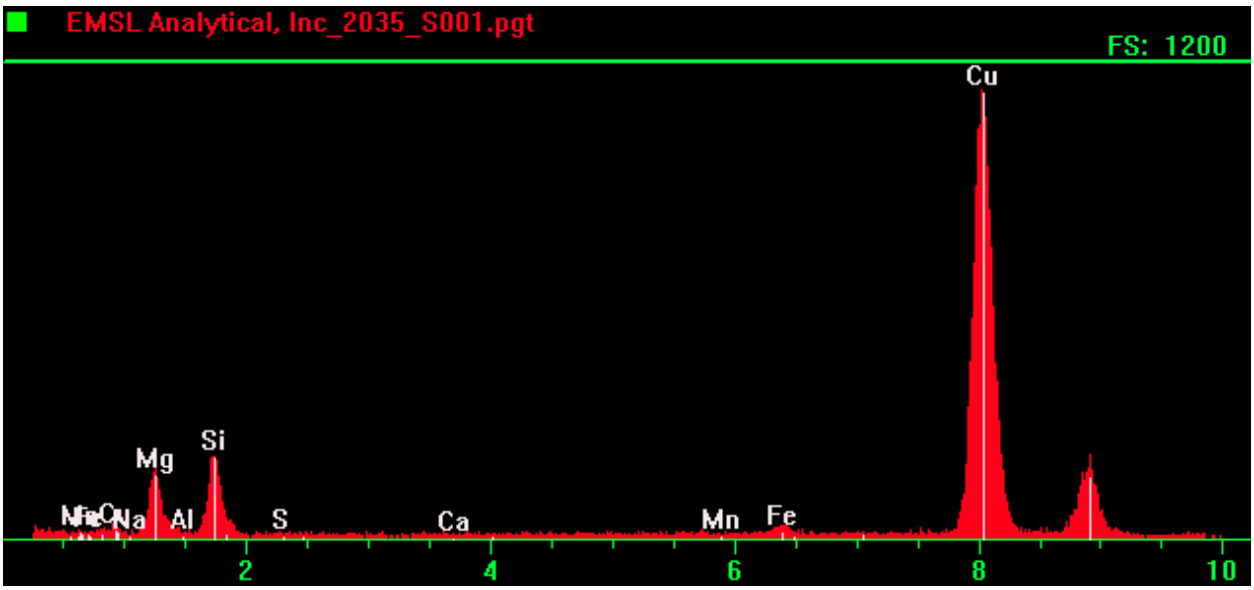
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	4.7	3.5	0.4	0.1
Mg	KA1	40.8	4.1	36.7	9.1
Al	KA1	4.5	4.1	0.5	0.1
Si	KA1	124.1	4.2	119.8	28.4
S	KA1	3.7	3.7	0.0	0.0
Ca	KA1	44.0	3.6	40.3	11.1
Mn	KA1	4.5	4.2	0.3	0.1
Fe	KA1	16.9	4.3	12.5	2.9
Cu	KA1	364.0	4.7	359.3	76.3

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0067_TEM_ISO_10312_EDX_Chrysotile
Collected: October 10, 2012 15:39:02

Live Time:	24.91	Count Rate:	3335	Dead Time:	39.58 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	12.9	12.0	0.0	0.0
Mg	KA1	129.4	12.5	116.9	9.3
Al	KA1	15.0	11.8	3.1	0.3
Si	KA1	172.5	11.5	161.0	14.0
S	KA1	12.3	10.5	1.8	0.2
Ca	KA1	12.2	10.8	1.4	0.1
Mn	KA1	16.0	15.9	0.1	0.0
Fe	KA1	41.1	17.3	23.7	1.4
Cu	KA1	1376.7	20.4	1356.3	66.6

EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43991 SCOPE # 2

Reference / Sample Number: 67

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.6 mm
Mean Distance between spots on Center row (d2): 4.75 mm
Mean distance between spots on slant vector (d1): 4.66 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.19**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**5.03**	5.099	**4.844**	**5.354**
d1 or hk1 (Camera K/slant vector dist.)	**5.13**	5.158	**4.900**	**5.416**
Ratio of hk0/hk1	**0.98**	0.99	**0.941**	**1.040**
Angle of Slant Vector (Measured)	85.0	82.0	**77.900**	**86.100**

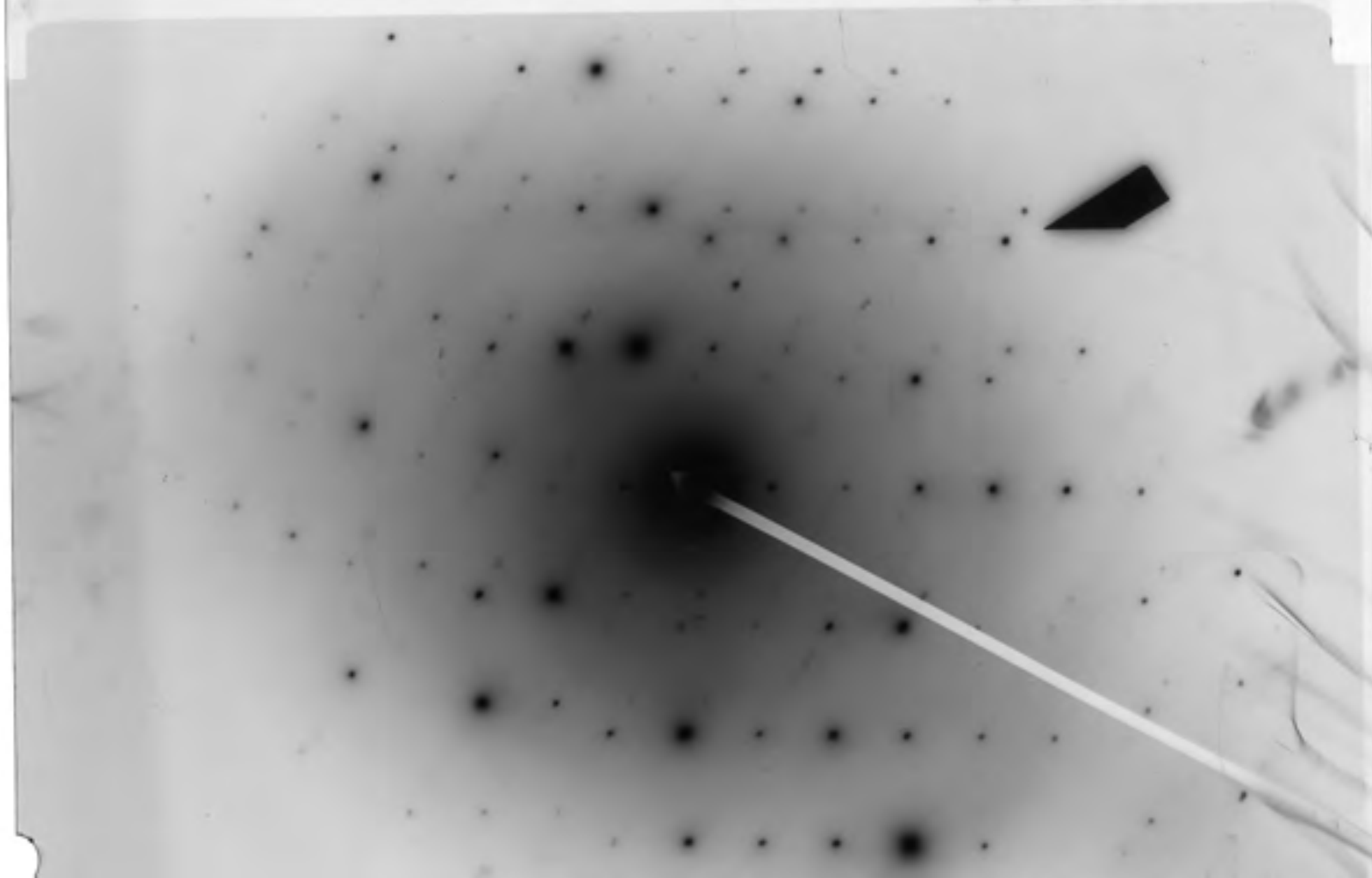
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [3 -1 0]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9843991



CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: ~~43978~~ 43981 12/4/12 pm SCOPE #: 2

Reference / Sample Number: 67

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.66 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

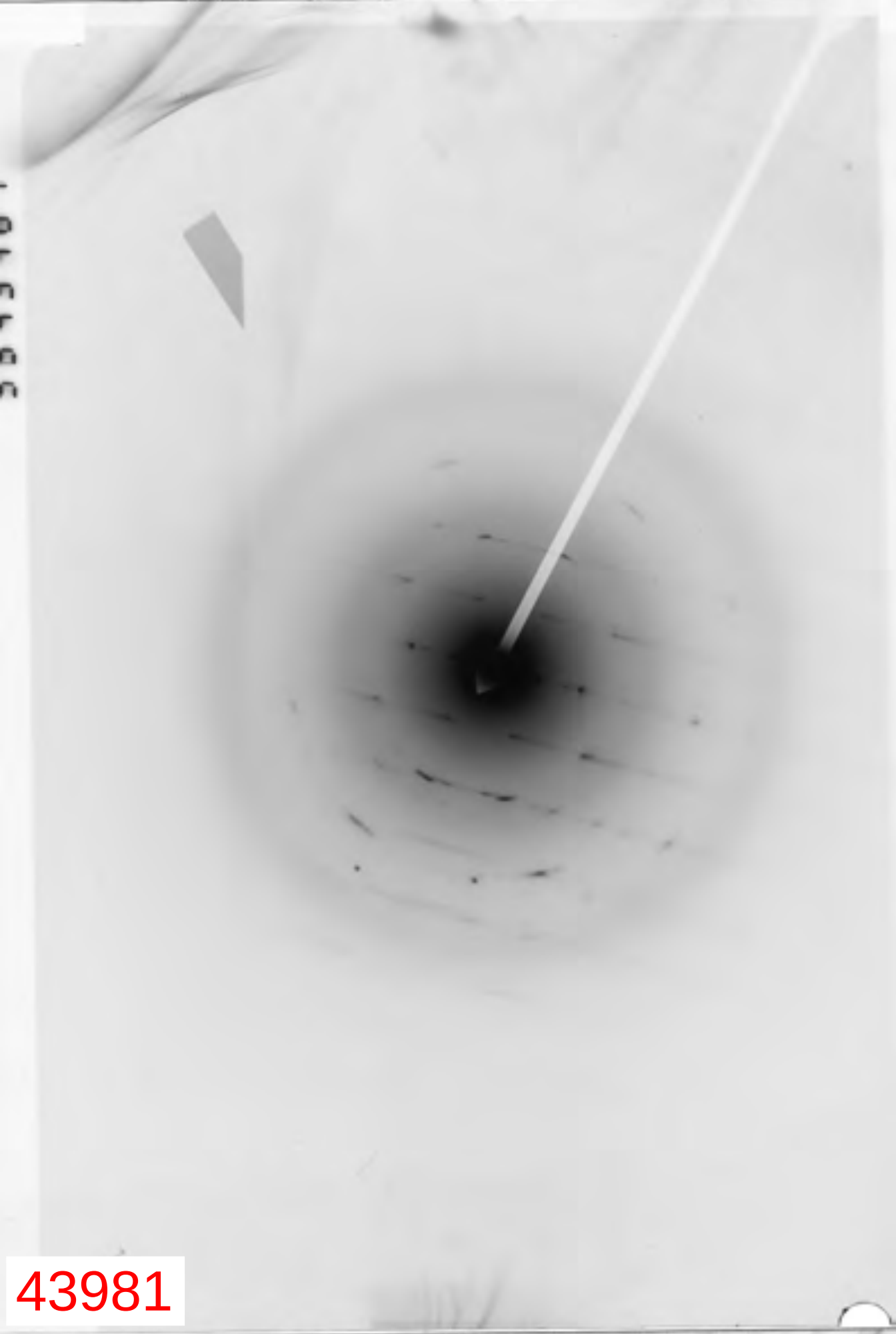
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.14**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43981

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0008 ~~8~~	Volume (L):	763	Scope:	09-02
Customer Sample:	HM-BG-HK-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	R, 4-6	Analysis Date:	10/10/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)		**Comments:**
GO Required:	10	none	3:1	5:1
GO Analyzed:	0			OVERLOADED
Level of Analysis Chrysotile:	CD~~Ø~~ 11/27/12 JM	Min Length:	>5 ~~0.5~~ 11/27/12 JM micron	18%
Level of Analysis Amphibole:	ADX	Min Width:	0.25 ~~NONE~~ micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					

ND= None Detected NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912211943-0008 ~~68~~ 11/29/12 DM	Volume (L):	763	Scope:	04 01
Customer Sample:	HM-BG-HK-04	Prepped By:	DK	GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:	9/19/12	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412-ERRG-01	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	H/7-9	Analysis Date:	11/15/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	10		none	3:1	5:1
GO Analyzed:	~~10~~ 11 11/25/12 DM				
Level of Analysis Chrysotile:	CD~~Q~~ 11/29/12 DM		Min Length:	>0.5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

15% Particulate Loading
Vertical TD

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
H7	B5	MD11	0		8.3	2.8					
		MF		0	8.3	1.2	ADX	ACT		011429	1
		MD11	1		56	38			NAM NAM		
		MF		1	13	2.5	AX	ACT			1
		MD11	2		10.2 ~~7.8~~	2					
		MB		2	10.2 ~~7.8~~	1.3	CD	CH		011431	1
	D6	MD11	3		8.1	2.7					
		MB		3	8.1	1	CD	CH			
		MD11	4		5.5	1.7					
		MB		4	5.5	.8	CD	CH			

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0068 ~~68~~ 11/29/12 DM	Volume (L):	763	Scope:	04 01
Customer Sample:	HM-BG-HK-04	Prepped By:		GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:		Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412-ERRG-01	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	H/7-9	Analysis Date:	11/15/2012

Analysis Information

Target Sensitivity:	0.004	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	10 11/29/12 DM		none	3:1	5:1
GO Analyzed:	~~10~~ 11				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/29/12 DM		Min Length:	>0.5	micron
Level of Analysis Amphibole:	ADX		Min Width:	≥0.25	micron

Comments:

15% Particulate Loading
Vertical TD

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
H7	E9	MC11	5	5	33	29	CD	CH			
	F4	F	6	6	7.5	1	ADX	ACT			
		MD11	0		6.2	1.4					
		MF		0	6.2	.5	ADX	NRA		011432	1
		B	7	7	5.3	.7	CD	CH			
	G7	ND									
	I6	MC11	8	8	15	9.5	ADX	ACT			
H8	B4	MD11	0		9.7	5.5					
		MF		0	7.6	.4	ADX	NRA			

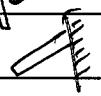
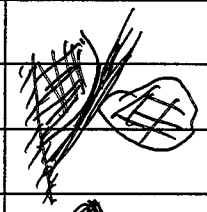
ISO 10312

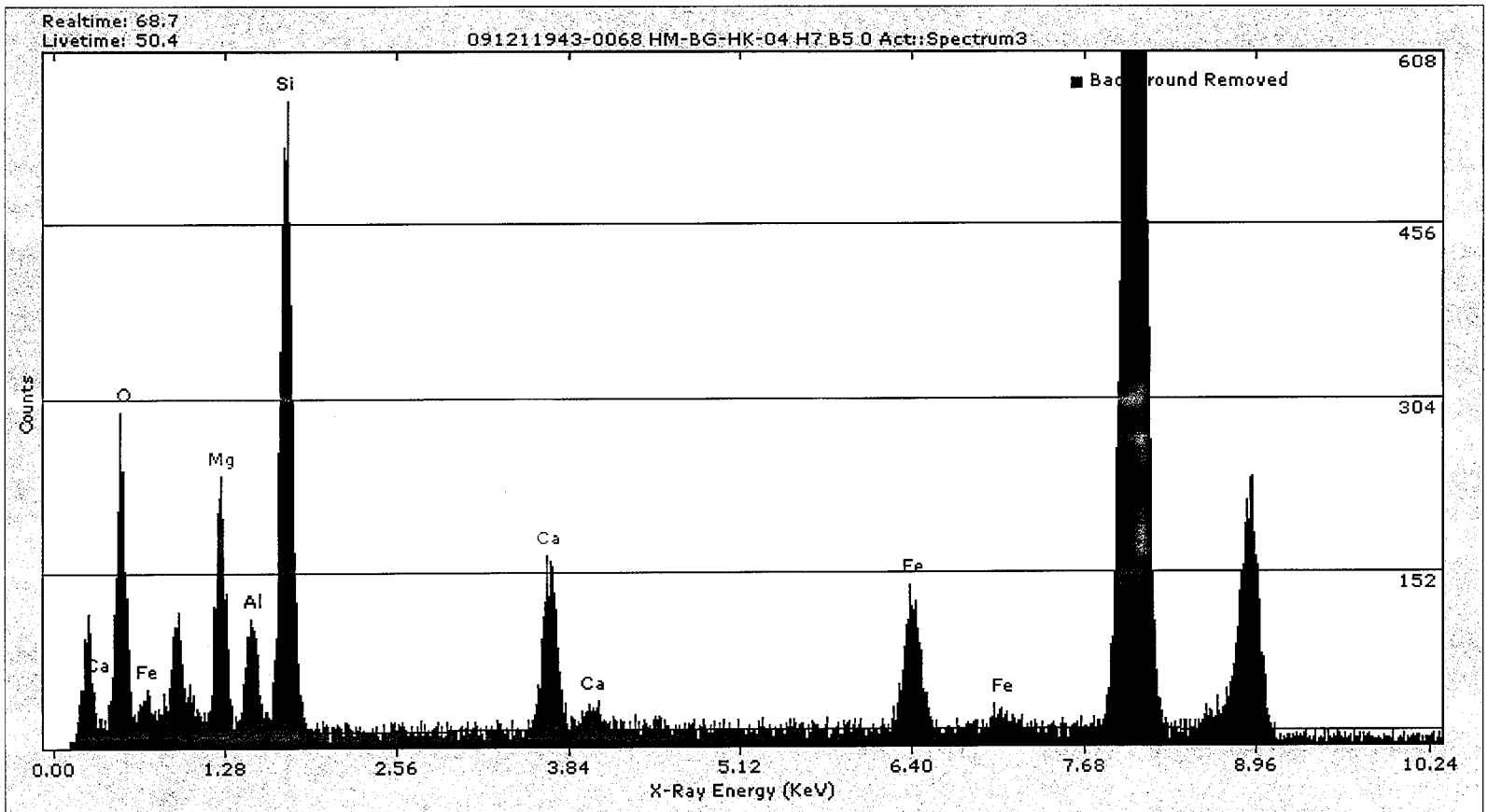
TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0008 ~~68~~ 11/29/12 DM	Volume (L):	763	Scope:	04 01
Customer Sample:	HM-BG-HK-04	Prepped By:		GO area (mm2):	0.0132
Sample Description:	AIR	Prepped Date:		Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	0412-ERRG-01	Analyzed By:	F Craig
EFA (mm^2):	385	Grid Location:	H/7-9	Analysis Date:	11/15/2012

Analysis Information

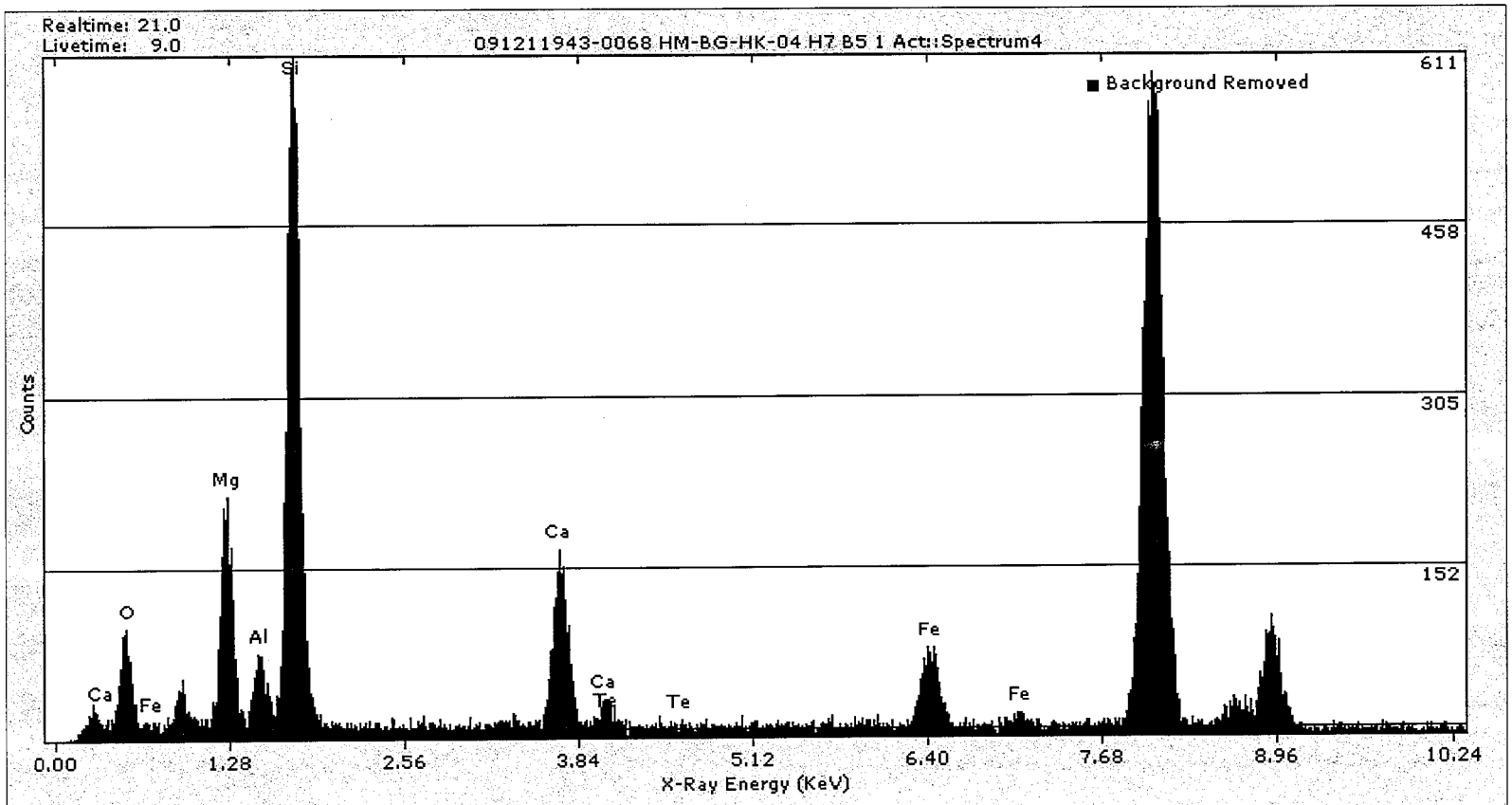
Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	10	none	3:1	5:1	
GO Analyzed:	~~10~~ 11 11/29/12 DM				15% Particulate Loading
Level of Analysis Chrysotile:	CD~~0~~ 11/29/12 DM	Min Length:	>0.5	micron	Vertical TD
Level of Analysis Amphibole:	ADX	Min Width:	≥0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
H8	B6	F	0	0	10.5	.3	ADX	NRA			
		F	9	9	11	1	ADX	ACT			
	D3	ND									
	F2	ND									
	I6	MD11	0		24	16					
		MB		0	11	.7	CD	CH			
		MD11	10		24	4					
		MB		10	23.5	3	CD	CH			



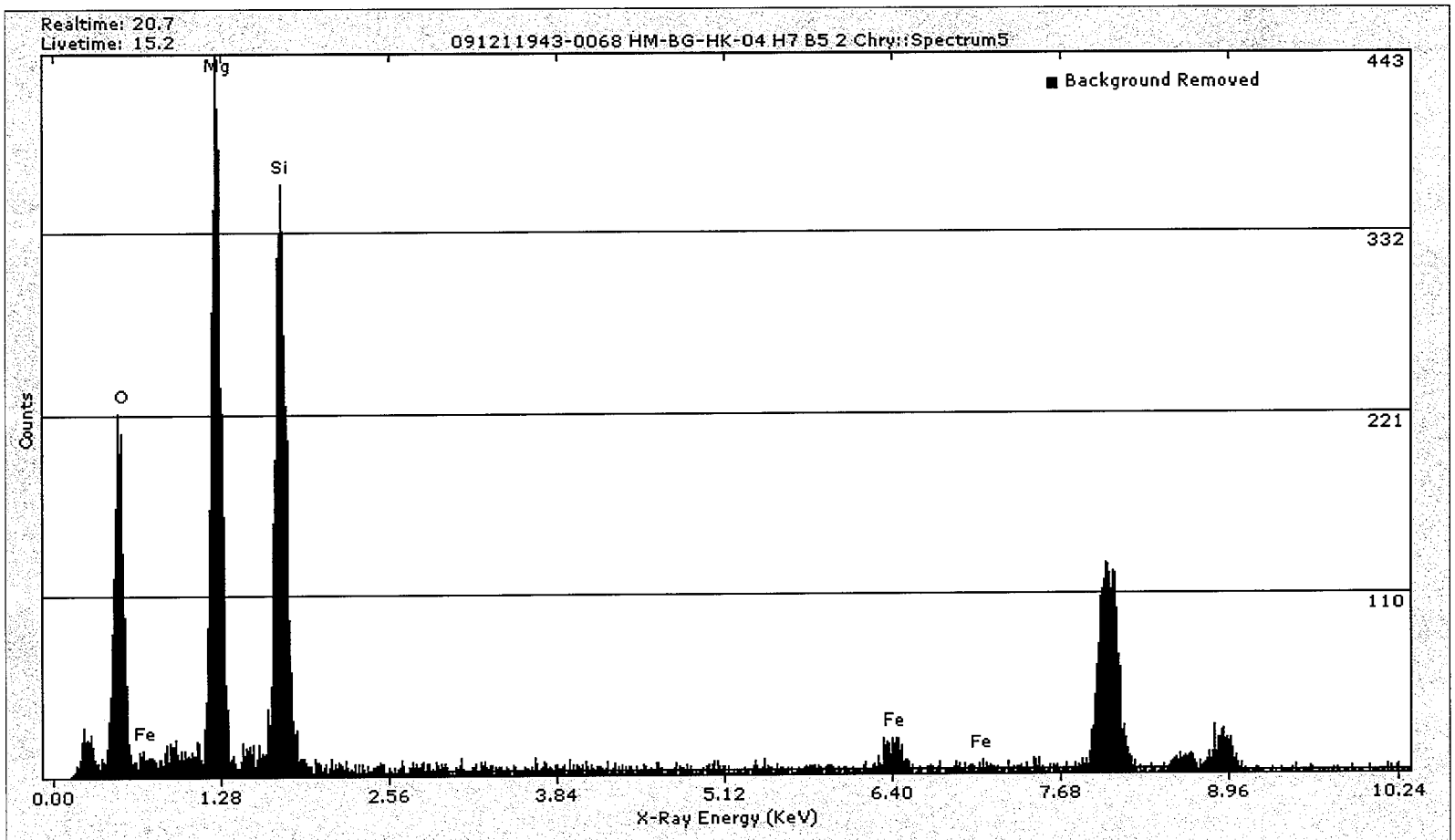
Quantitative Results for Spectrum3
Analysis: Thin Film Method: Standardless
Acquired 15-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	44.46	1.18	60.51	0.00		0.0000	0.0	85.8	1975.37
Magnesium	10.20	0.15	9.14	16.92	(MgO)	0.1637	1566.9	95.5	1626.77
Aluminum	4.75	0.07	3.83	8.98	(Al2O3)	0.0769	805.1	98.4	843.18
Silicon	24.62	0.37	19.09	52.68	(SiO2)	0.3654	4408.5	101.4	4564.94
Calcium	7.85	0.12	4.26	10.98	(CaO)	0.0668	1460.9	122.2	1524.23
Iron	8.12	0.12	3.17	10.44	(FeO)	0.0573	1201.1	146.1	1346.76
Total	100.00			100.00					



Quantitative Results for Spectrum4
Analysis: Thin Film Method: Standardless
Acquired 15-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	45.78	1.80	61.34	0.00		0.0000	0.0	85.9	775.97
Magnesium	10.37	0.15	9.14	17.19	(MgO)	0.1884	1488.2	95.7	1594.81
Aluminum	2.60	0.04	2.07	4.92	(Al2O3)	0.0478	412.1	98.6	532.86
Silicon	28.11	0.41	21.45	60.14	(SiO2)	0.4715	4726.4	101.6	5100.71
Tellurium	0.57	0.01	0.10	0.79	(TeO3)	0.0327	69.9	122.3	
Calcium	7.12	0.10	3.81	9.96	(CaO)	0.0699	1240.4	122.3	1507.34
Iron	5.45	0.08	2.09	7.01	(FeO)	0.0458	753.6	146.3	866.31
Total	100.00			100.00					



Quantitative Results for Spectrum5
Analysis: Thin Film Method: Standardless
Acquired 15-Nov-2012, 100.0 KeV @10 eV/channel

Element	Weight %	Std. Dev.	Atomic %	Oxide %		k-Ratio	Intensities	FWHM (eV)	ROI (net)
Oxygen	45.87	0.83	58.16	0.00		0.0000	0.0	85.8	1595.04
Magnesium	29.83	0.54	24.90	49.47	(MgO)	0.3987	3066.5	95.5	3140.28
Silicon	22.60	0.41	16.32	48.34	(SiO2)	0.2836	2708.9	101.4	2932.59
Iron	1.70	0.03	0.62	2.19	(FeO)	0.0120	168.6	146.1	222.04
Total	100.00			100.00					

AMPHIBOLE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 15, 2012

Image Number: 011429

Sample Number: 0068-04-01

Preliminary ID: Actinolite

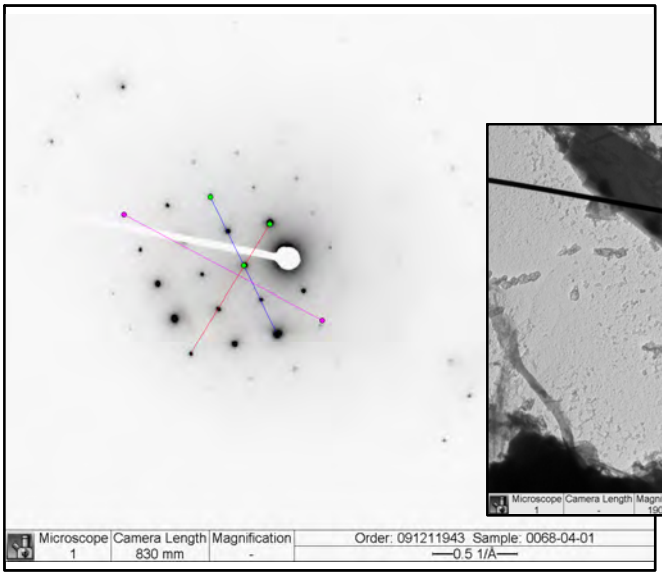
Camera Constant: 2.944e-003 **1/A Pixels**

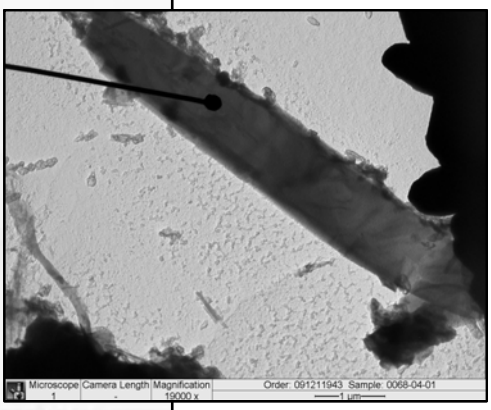
Calibration Reference: 111312.AuCal_11428

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.240**	5.278	**5.014**	**5.542**
d2 or hk0 (Camera K/zero row dist.):	**3.378**	3.385	**3.216**	**3.554**
d1 or hkl (Camera K/slant vector dist.):	**4.508**	4.482	**4.258**	**4.706**
Ratio of hk0/hkl:	**0.749**	0.755	**0.717**	**0.793**
Vector Angle:	**57.4**	57.140	**54.283**	**59.997**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **ACTINOLITE**

With a Zone Axis of: **[5 -1 2]**





Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

CHRYSOTILE SAED INDEXING FORM

EMSL Order Number: 091211943 **Date:** Nov 15, 2012

Image Number: 011431

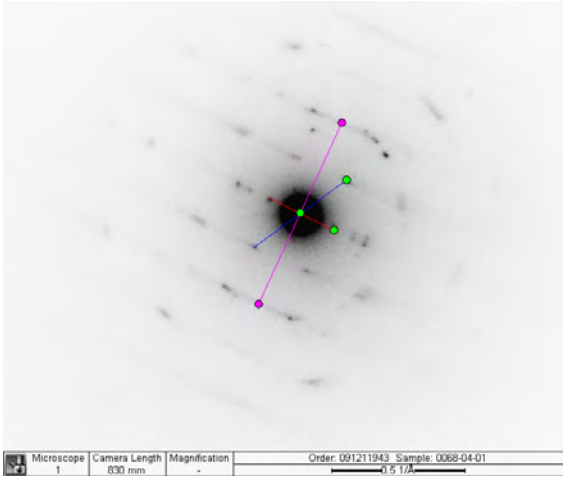
Reference / Sample Number: 0068

Preliminary ID: Chrysotile

Camera Constant: 2.944e-003 **1/A Pixels**

Calibration Reference: 111312.AuCal_11428

	Measured	Reference	-5%	+5%
Inter-row Spacing:	**5.346**	5.3	**5.06**	**5.56**
Vector Angle:	**62.4**	60	**58**	**63**
d2 or hk0 (Camera K/zero row dist.):	**7.338**	7.32	**6.95**	**7.68**
d1 or hkl (Camera K/slant vector dist.):	**4.652**	4.58	**4.35**	**4.81**



From SAED Reference Book, "unknown" diffraction pattern was found to be that of: **Chrysotile**

Preliminary Identification was:

X	CORRECT
	INCORRECT

Indexed By: F Craig

EMSL Analytical 200 Rt 130 North, Cinnaminson, NJ 08077
TEL: (800) 220-3675 FAX: (856) 786-5974 www.EMSL.com

ISO 10312

TEM Asbestos Count Sheet

11/28/12-am

EMSL Sample ID:	0912111943-0069	Volume (L):	705	Scope:	09-0 2
Customer Sample:	HM-BG-RS-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD \ RD
EFA (mm^2):	385	Grid Location:	S, 4-6	Analysis Date:	10/10/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 -am	Min Length:	>5 ~~2~~	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
S4	B7	B	1	1	8.1	1.4	CD	CHRYS		43983	YES
S4	B7	B	2	2	31.4	8.8	CD	CHRYS			
S4	B5	ND									
S4	B3	ND									
S4	B1	ND									
S5	G1	B	3	3	10.1	1.35	CD	CHRYS			
S5	G3	B	4	4	12.6	2.3	CD	CHRYS			
S5	G5	ND									
S6	C9	B	5	5	14.6	2.4	CD	CHRYS			
S6	C7	ND									
S6	C5	ND									
S6	F8	ND									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

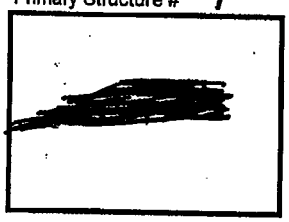
Structure Sketch Sheet

EMSL Order ID: 0912119413~~0~~0069 **Client:**

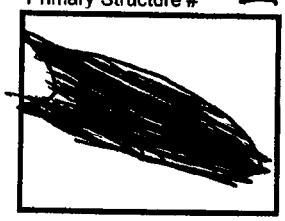
Client Sample:

Page 1 of 1

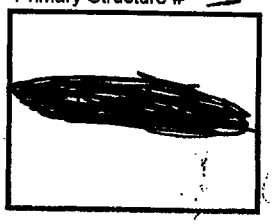
Primary Structure # 1



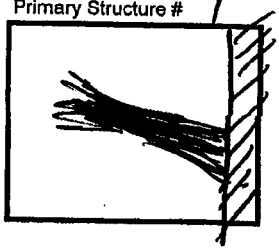
Primary Structure # 2



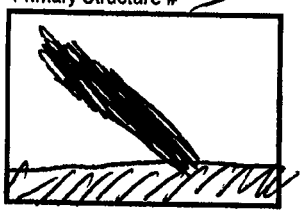
Primary Structure # 3



Primary Structure # 4



Primary Structure # 5



Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Primary Structure #

Structure #

Structure #

Structure #

Structure #

Analyst: KD

Date: 10OCT12

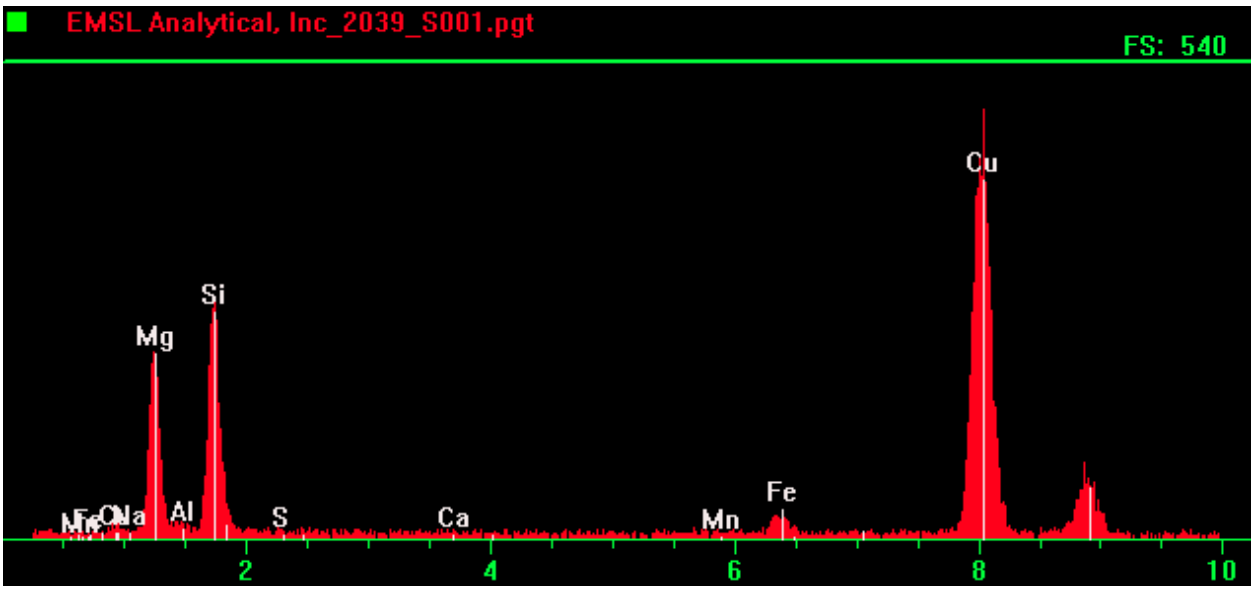
Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0069_TEM_ISO_10312_EDX_Chrysotile
Collected: October 10, 2012 17:20:34

Live Time:	20.64	Count Rate:	2064	Dead Time:	24.31 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	7.8	10.1	0.0	0.0
Mg	KA1	191.0	12.8	178.2	13.9
Al	KA1	15.1	12.8	2.3	0.2
Si	KA1	246.5	13.3	233.2	17.5
S	KA1	9.6	9.9	0.0	0.0
Ca	KA1	10.5	7.3	3.2	0.4
Mn	KA1	9.8	8.7	1.1	0.1
Fe	KA1	37.6	8.7	28.8	3.3
Cu	KA1	657.1	13.2	643.8	48.7

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43983 SCOPE #: 2

Reference / Sample Number: 69

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.625 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

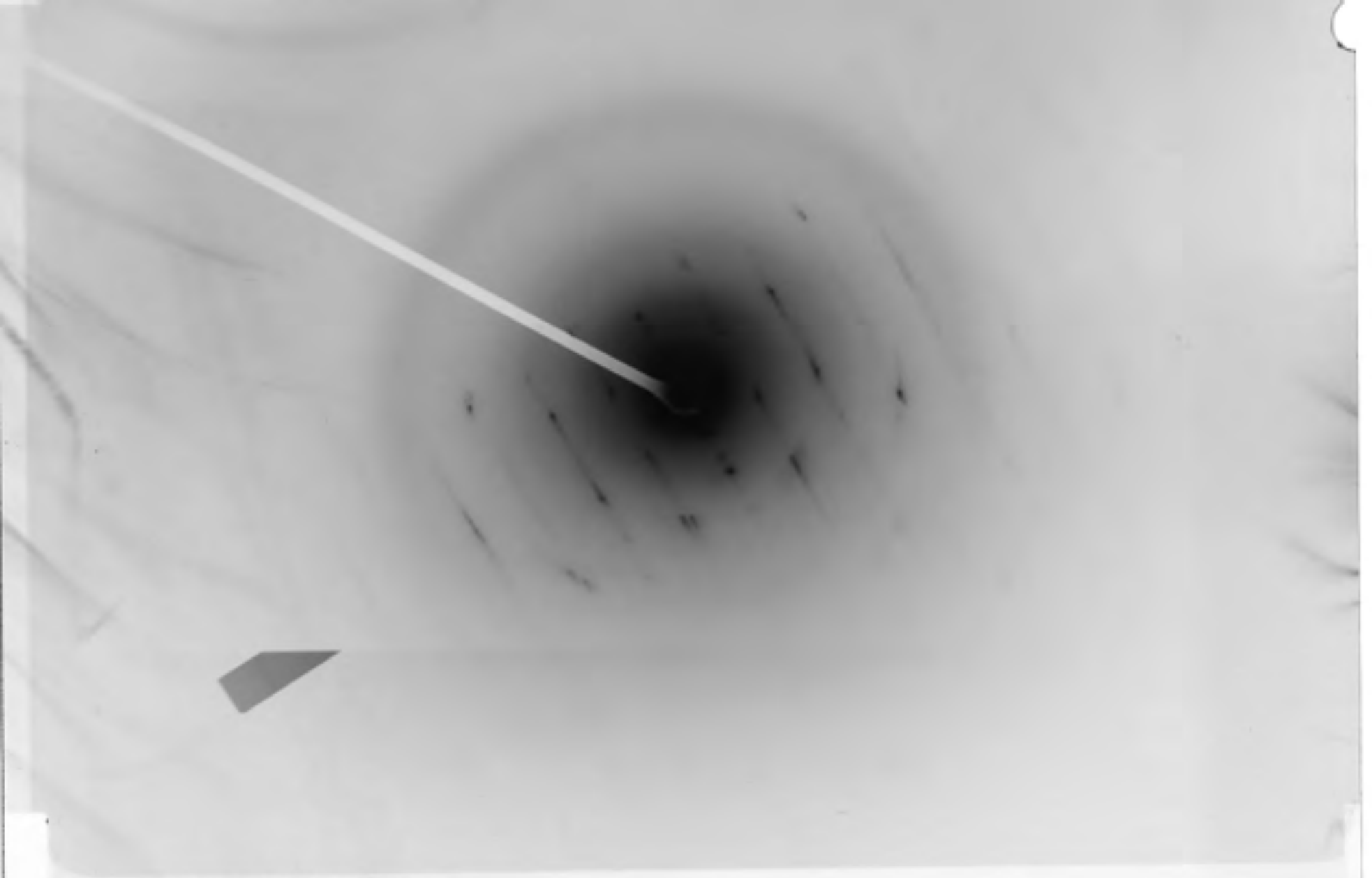
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.17**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	091211~~1~~943-0070	Volume (L):	705	Scope:	09-02
Customer Sample:	HM-BG-RS-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	T, 1-3	Analysis Date:	10/10/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~0~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
T1	F1	ND									
T1	F3	ND									
T1	F5	ND									
T1	F7	ND									
T1	F9	ND									
T2	E10	B	1	1	9.6	1.3	CD	CHRYS			
T2	E8	B	2	2	10	2.05	CD	CHRYS			
T2	E6	MD11	3		28.8	11.2	CD	CHRYS			
T2	E6	MB		3	6.9	0.3	CD	CHRYS			YES
T3	E10	MD11	4		22.5	7.3	CD	CHRYS			
T3	E10	MB		4	15.6	0.3	CD	CHRYS			
T3	E10	B	5	5	16.2	4.8	CD	CHRYS		9. 12/5/12 DM	
T3	E10	B	6	6	9.1	2.6	ADX	ACTIN		43~~8~~87	YES
T3	E8	ND									
T3	E6	B	7	7	10.2	1.5	CD	CHRYS		43989	

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312

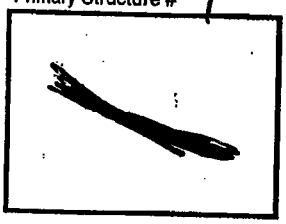
Structure Sketch Sheet

EMSL Order ID: 091211943-0070 **Client:**

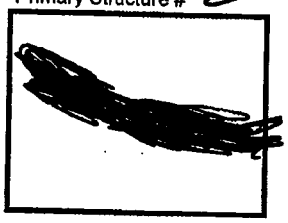
Client Sample:

Page 1 of 1

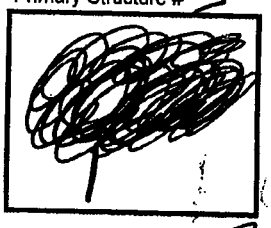
Primary Structure # 1



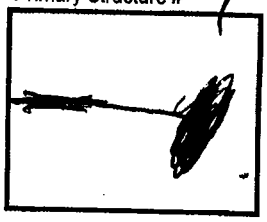
Primary Structure # 2



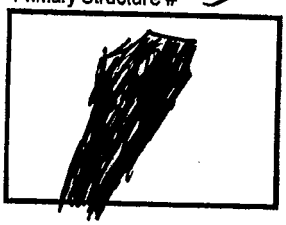
Primary Structure # 3



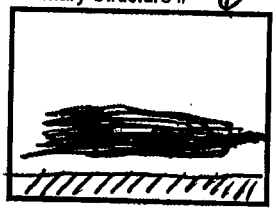
Primary Structure # 4



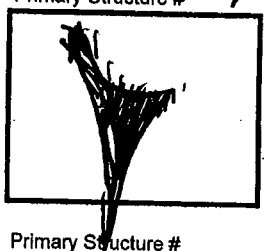
Primary Structure # 5



Primary Structure # 6



Primary Structure # 7



Primary Structure #

Primary Structure #

Primary Structure #

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Primary Structure #

Structure #

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Structure #

Structure #

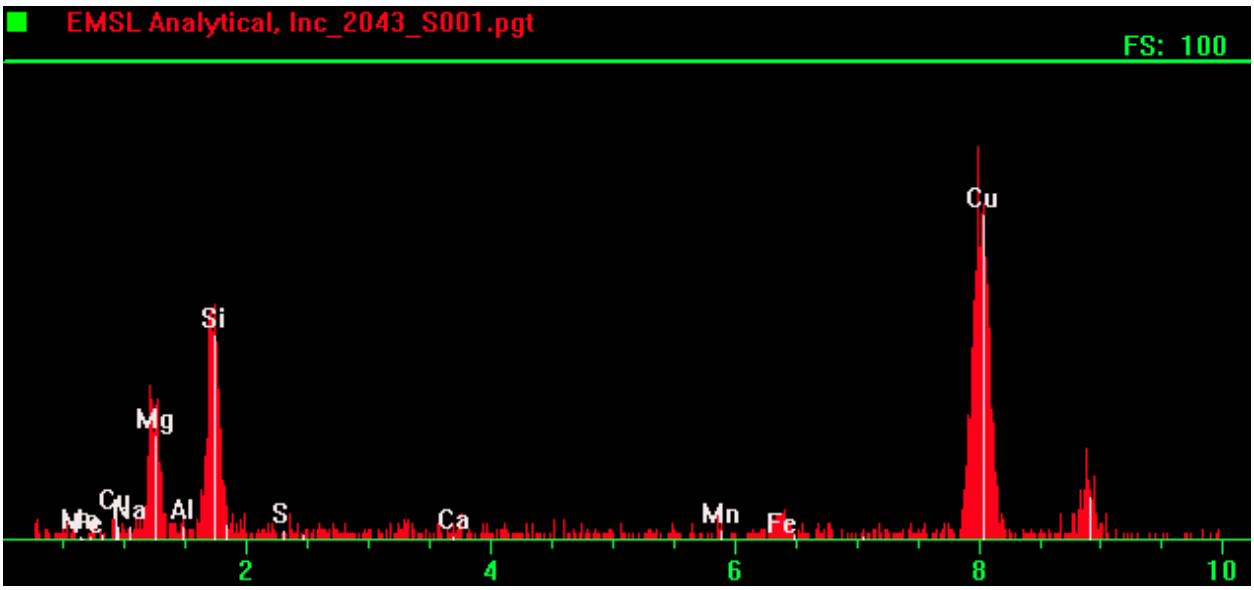
Analyst: KD Date: 10OCT12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0070_TEM_ISO_10312_EDX_Chrysotile
Collected: October 11, 2012 12:21:15

Live Time:	48.53	Count Rate:	139	Dead Time:	2.26 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



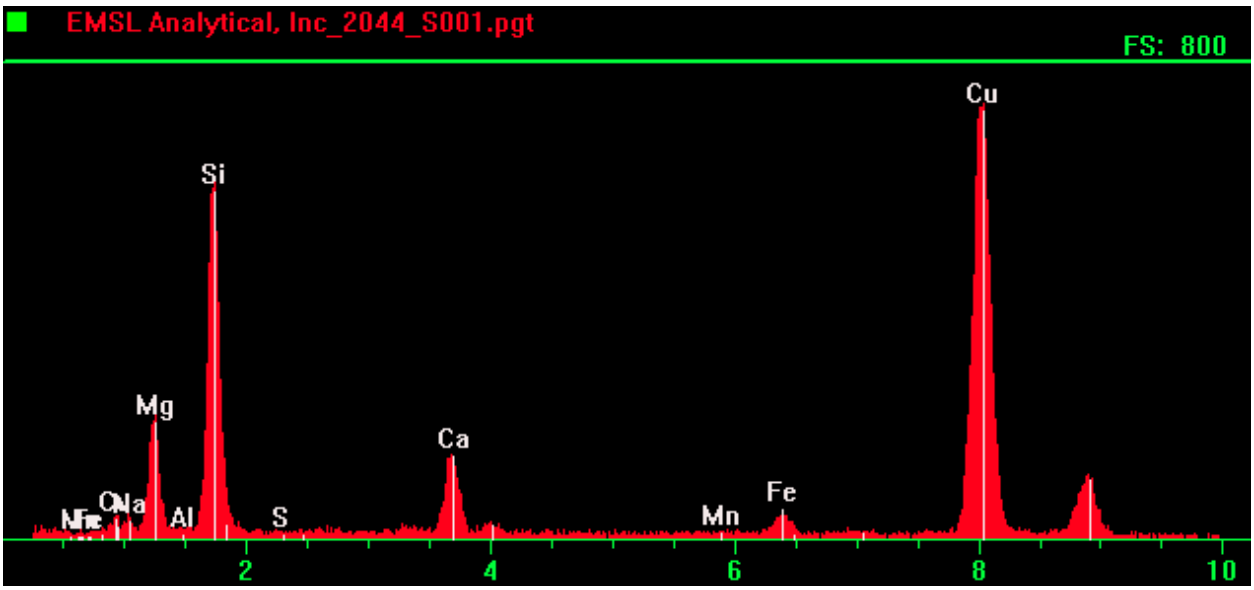
Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	0.9	0.5	0.3	0.6
Mg	KA1	12.1	1.1	11.0	10.5
Al	KA1	1.2	1.0	0.2	0.2
Si	KA1	17.8	1.0	16.8	16.3
S	KA1	0.8	0.5	0.3	0.5
Ca	KA1	1.0	0.0	1.0	0.0
Mn	KA1	0.6	0.7	0.0	0.0
Fe	KA1	3.0	0.7	2.2	3.0
Cu	KA1	43.5	0.8	42.7	53.1

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0070_TEM_ISO_10312_EDX_Actinolite
Collected: October 11, 2012 13:37:57

Live Time:	58.18	Count Rate:	1248	Dead Time:	14.74 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	10.2	4.3	4.9	1.2
Mg	KA1	65.1	5.0	60.2	12.2
Al	KA1	6.3	5.0	1.4	0.3
Si	KA1	199.8	5.2	194.7	37.8
S	KA1	5.2	4.9	0.3	0.1
Ca	KA1	58.5	5.7	52.9	9.3
Mn	KA1	5.7	4.8	0.8	0.2
Fe	KA1	19.1	5.0	14.1	2.8
Cu	KA1	366.5	5.4	361.2	67.4

EMSL

AMPHIBOLE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43987 SCOPE # 2

Reference / Sample Number: 70

Preliminary ID: Actinolite By: KD

Using Camera Constant of: 23.89 mm Angstroms

Determined from negative number: 42713

Measured Inter-row spacing: 4.7 mm
Mean Distance between spots on Center row (d2): 4.2 mm
Mean distance between spots on slant vector (d1): 4.5 mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.08**	5.300	**5.035**	**5.565**
d2 or hk0 (Camera K/zero row dist.)	**5.69**	5.099	**4.844**	**5.354**
d1 or hk1 (Camera K/slant vector dist.)	**5.31**	5.158	**4.900**	**5.416**
Ratio of hk0/hk1	**1.07**	103.00	**97.850**	**108.150**
Angle of Slant Vector (Measured)	84.0	85.1	**80.845**	**89.355**

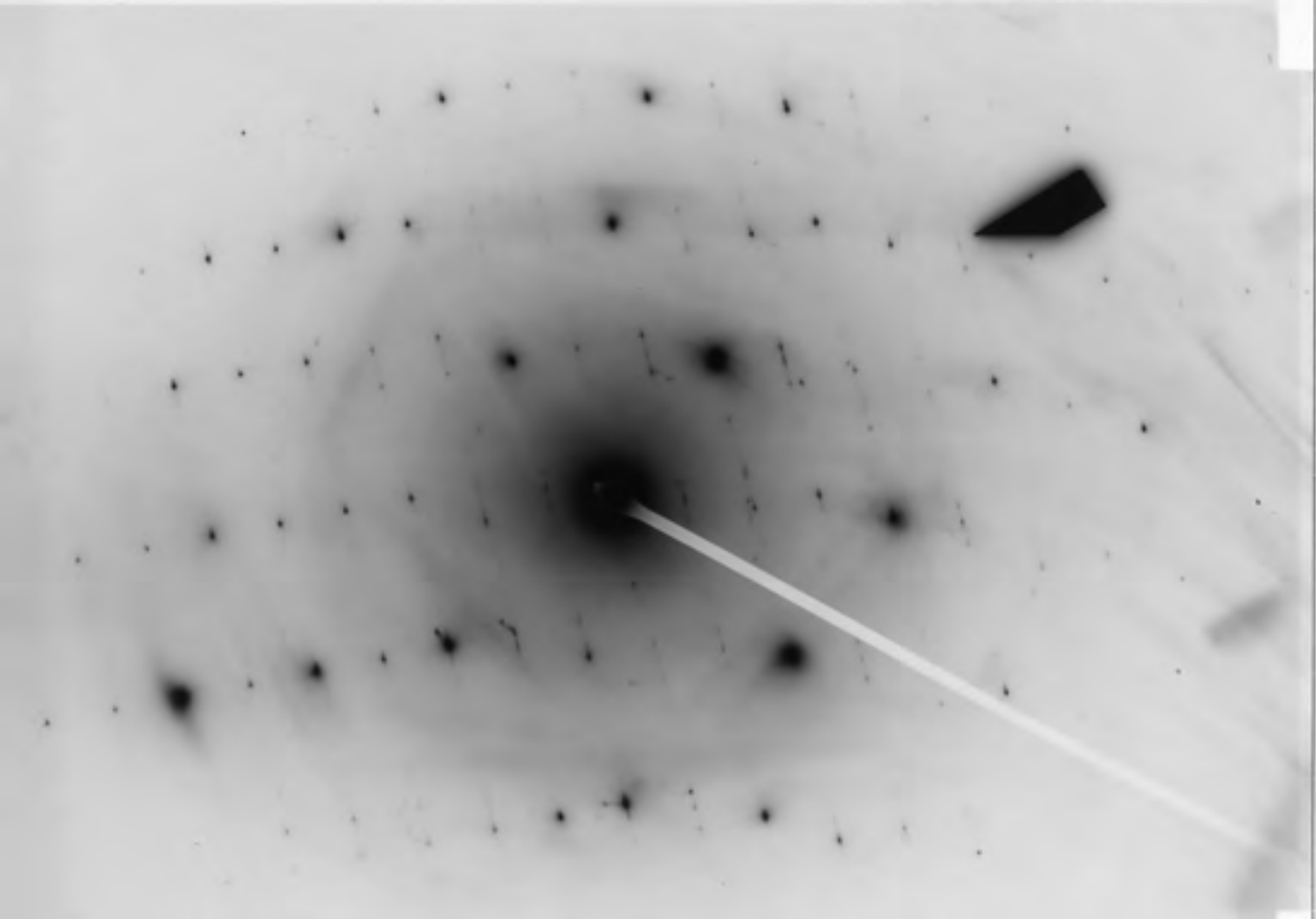
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Actinolite By: KD
With a Zone Axis of: [3 -1 4]

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

5843481



EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43989 SCOPE #: 2

Reference / Sample Number: 70

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.46 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

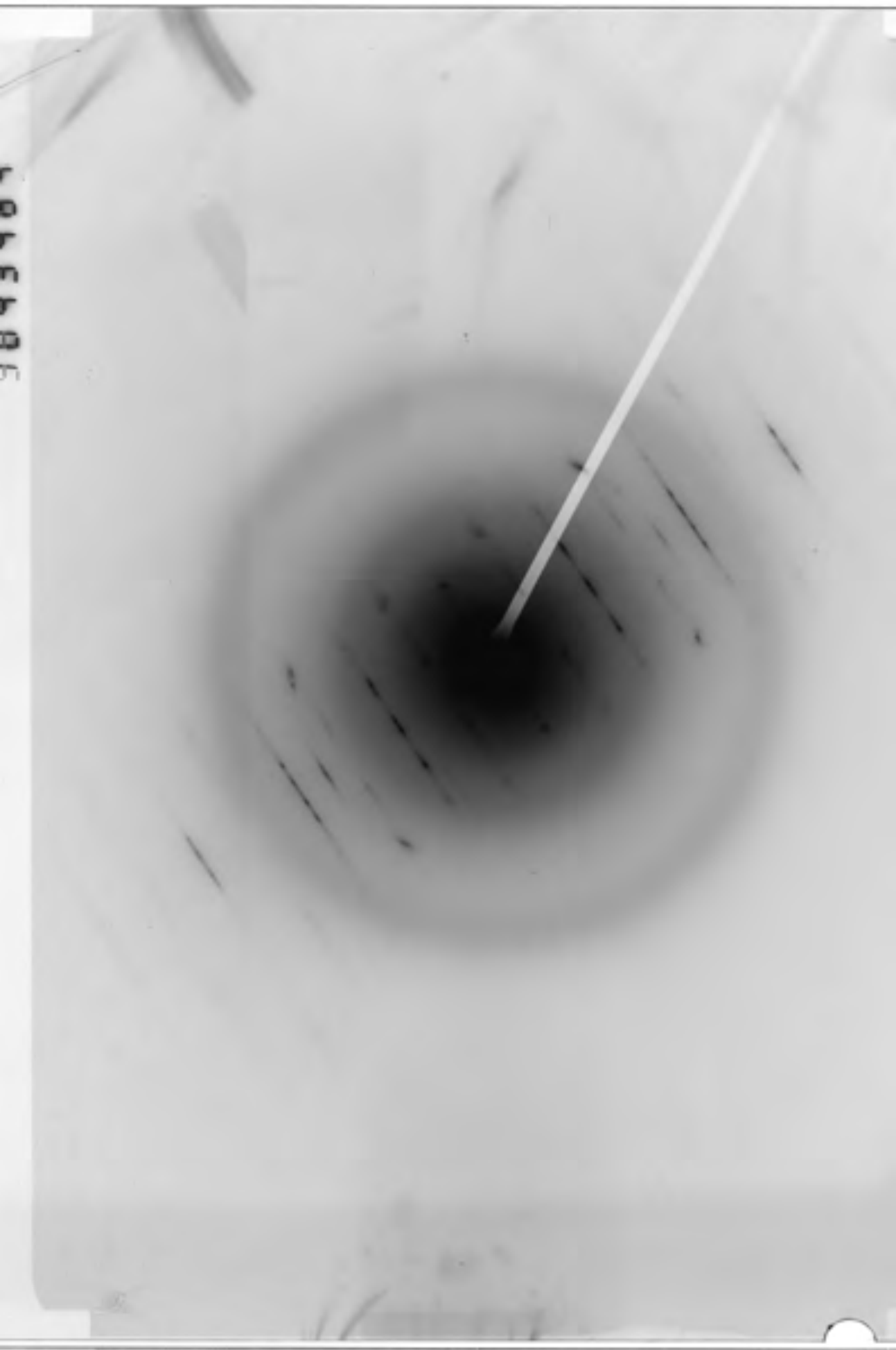
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.37**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	60	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	0912111943-0071	Volume (L):	684	Scope:	09-02
Customer Sample:	HM-BG-RS-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	T, 4-6	Analysis Date:	10/11/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
T4	F1	B	1	1	21.6	3.8	CD	CHRYS		43990	YES
T4	F3	ND									
T4	F5	ND									
T4	F7	B	2	2	16.1	4.95	CD	CHRYS			
T5	F1	ND									
T5	F3	ND									
T5	F5	B	3	3	10.6	1.9	CD	CHRYS			
T5	F7	ND									
T6	F1	ND									
T6	F3	ND									
T6	F5	ND									

ND= None Detected NAM= Non Asbestos Material

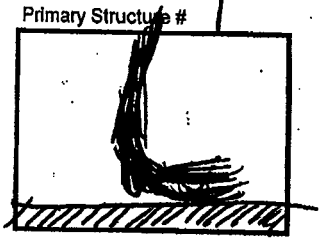
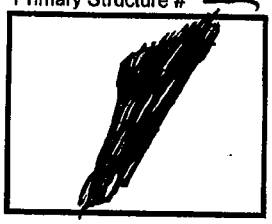
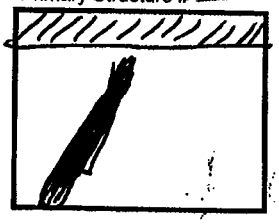
TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 091211943-74 **Client:**

Client Sample:

Page 1 of 1

Primary Structure # 1	Primary Structure # 2	Primary Structure # 3	Primary Structure #
			
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Structure #	Structure #	Structure #	Structure #

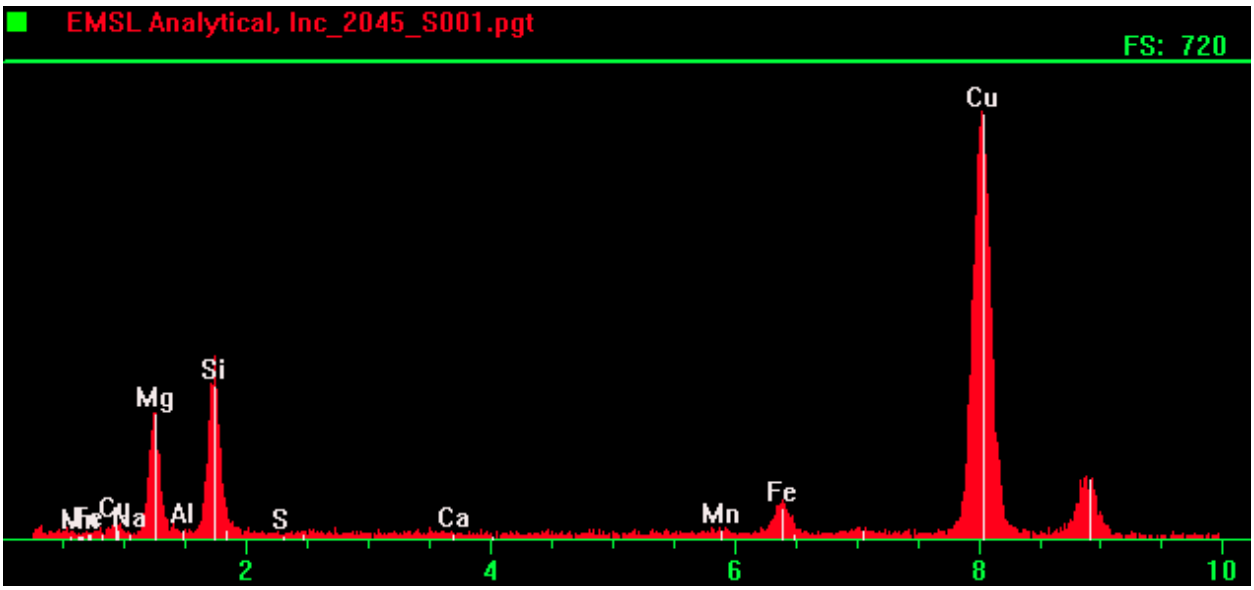
Analyst: KD Date: 11OCT12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0071_TEM_ISO_10312_EDX_Chrysotile
Collected: October 11, 2012 13:51:03

Live Time:	27.38	Count Rate:	1920	Dead Time:	23.48 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	7.6	7.6	0.0	0.0
Mg	KA1	122.6	8.8	113.8	13.0
Al	KA1	10.9	9.6	1.3	0.1
Si	KA1	175.7	10.0	165.6	16.5
S	KA1	7.2	8.2	0.0	0.0
Ca	KA1	9.1	6.6	2.5	0.4
Mn	KA1	13.4	8.9	4.4	0.5
Fe	KA1	52.5	9.2	43.0	4.7
Cu	KA1	693.6	12.6	681.0	54.0

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43990 SCOPE #: 2

Reference / Sample Number: 71

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.48 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

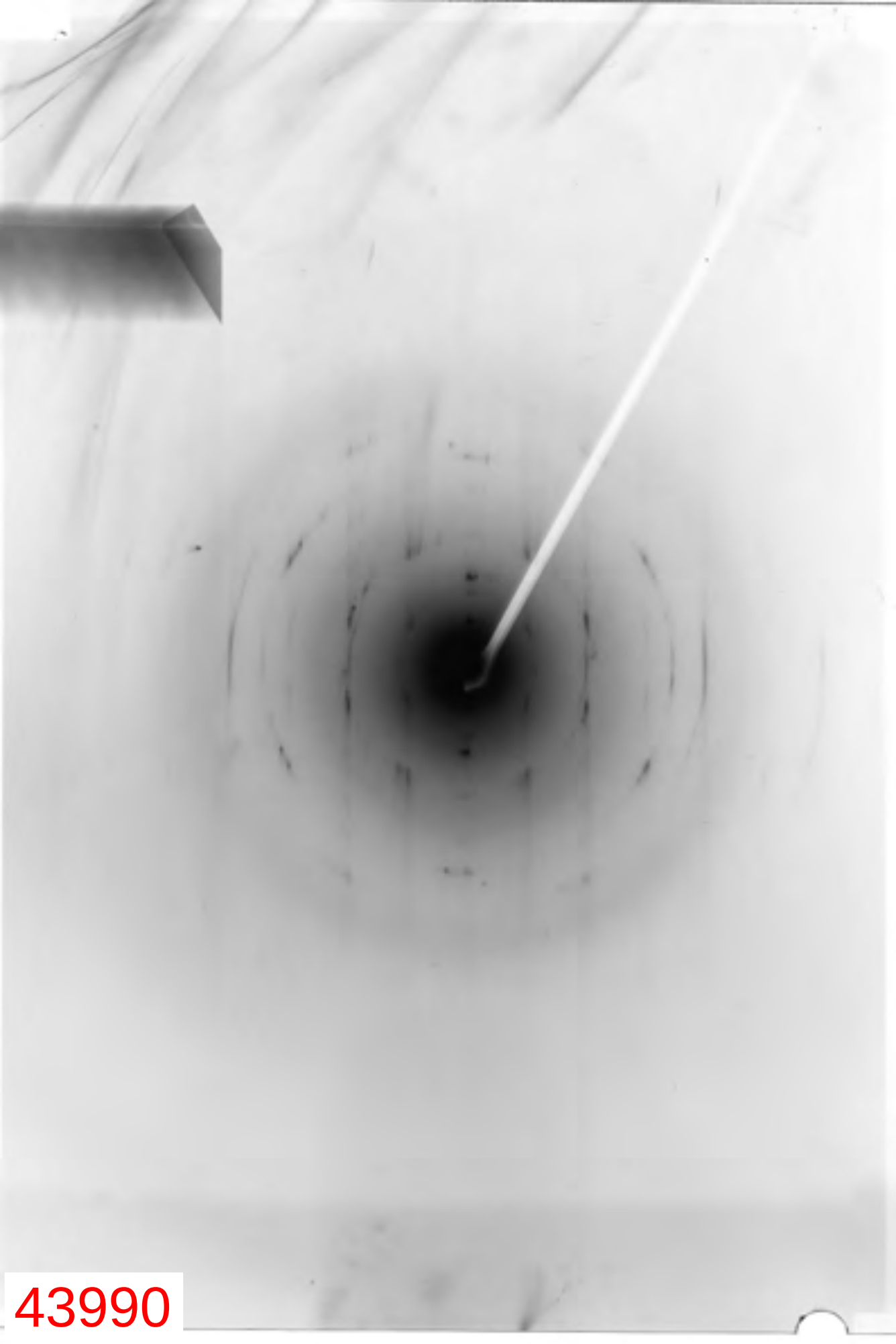
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.34**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	59	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43990

ISO 10312

TEM Asbestos Count Sheet

11/27/12 DM

EMSL Sample ID:	091211~~1~~943-0072	Volume (L):	678	Scope:	09-02
Customer Sample:	HM-BG-RS-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	U, 1-3	Analysis Date:	10/11/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CD~~Q~~ 11/27/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
U1	D10	ND									
U1	D8	ND									
U1	D6	ND									
U1	D4	ND									
U2	F1	ND									
U2	F3	ND									
U2	F5	ND									
U2	F7	MD11	1		16.6	7.8	CD	CHRYS			
U2	F7	MB		1	16.6	4.1	CDQ	CHRYS		43993	YES
U3	E10	ND									
U3	E8	ND									
U3	E6	B	2	2	22.2	4.55	CD	CHRYS			
U3	E6	B	3	3	7.3	1.6	CD	CHRYS			

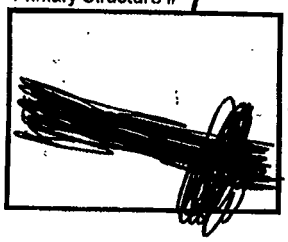
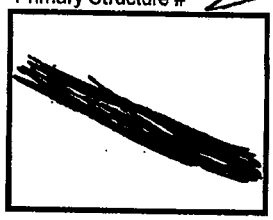
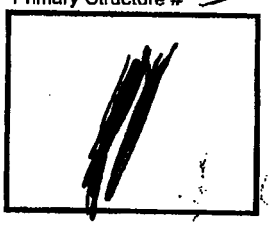
ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 0912119413-0072 **Client:**

Client Sample: _____ Page 1 of 1

Primary Structure # 1	Primary Structure # 2	Primary Structure # 3	Primary Structure #
			
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Structure #	Structure #	Structure #	Structure #

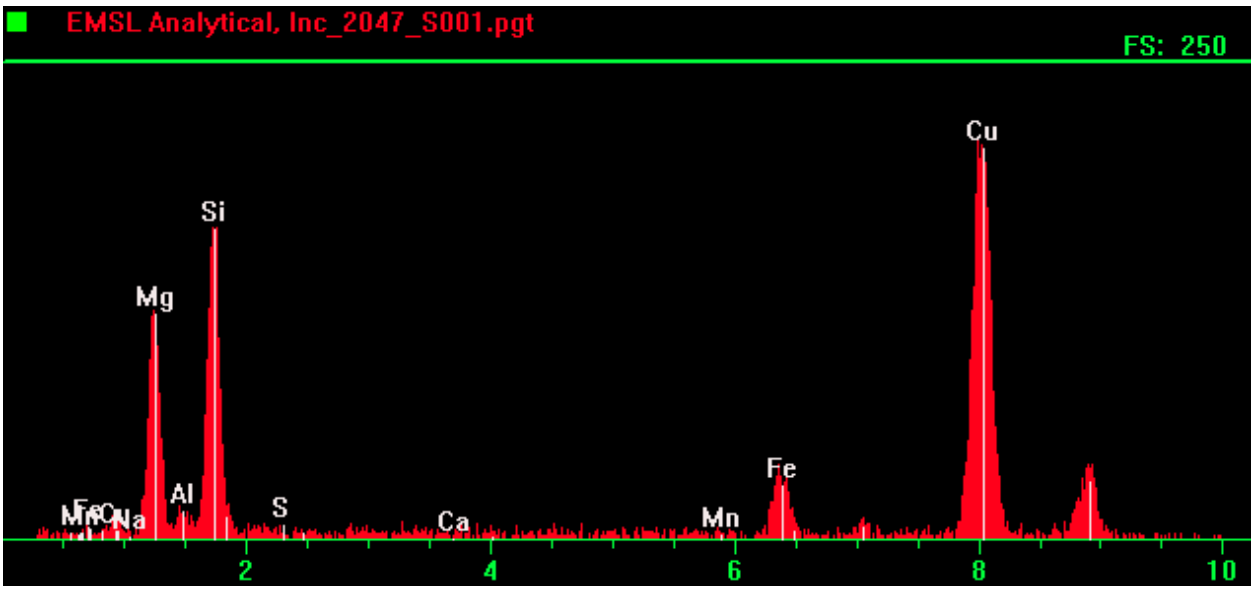
Analyst: KD Date: 17 OCT 12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0072_TEM_ISO_10312_EDX_Chrysotile
Collected: October 11, 2012 14:25:52

Live Time:	25.61	Count Rate:	886	Dead Time:	10.89 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.6	6.1	0.0	0.0
Mg	KA1	88.6	8.0	80.5	10.0
Al	KA1	11.6	8.4	3.2	0.4
Si	KA1	128.5	8.1	120.4	14.9
S	KA1	4.1	5.0	0.0	0.0
Ca	KA1	3.8	2.3	1.4	0.6
Mn	KA1	4.1	5.5	0.0	0.0
Fe	KA1	36.2	6.0	30.2	5.0
Cu	KA1	246.3	6.1	240.2	39.4

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43993 SCOPE #: 2

Reference / Sample Number: 72

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.52 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.05	mm

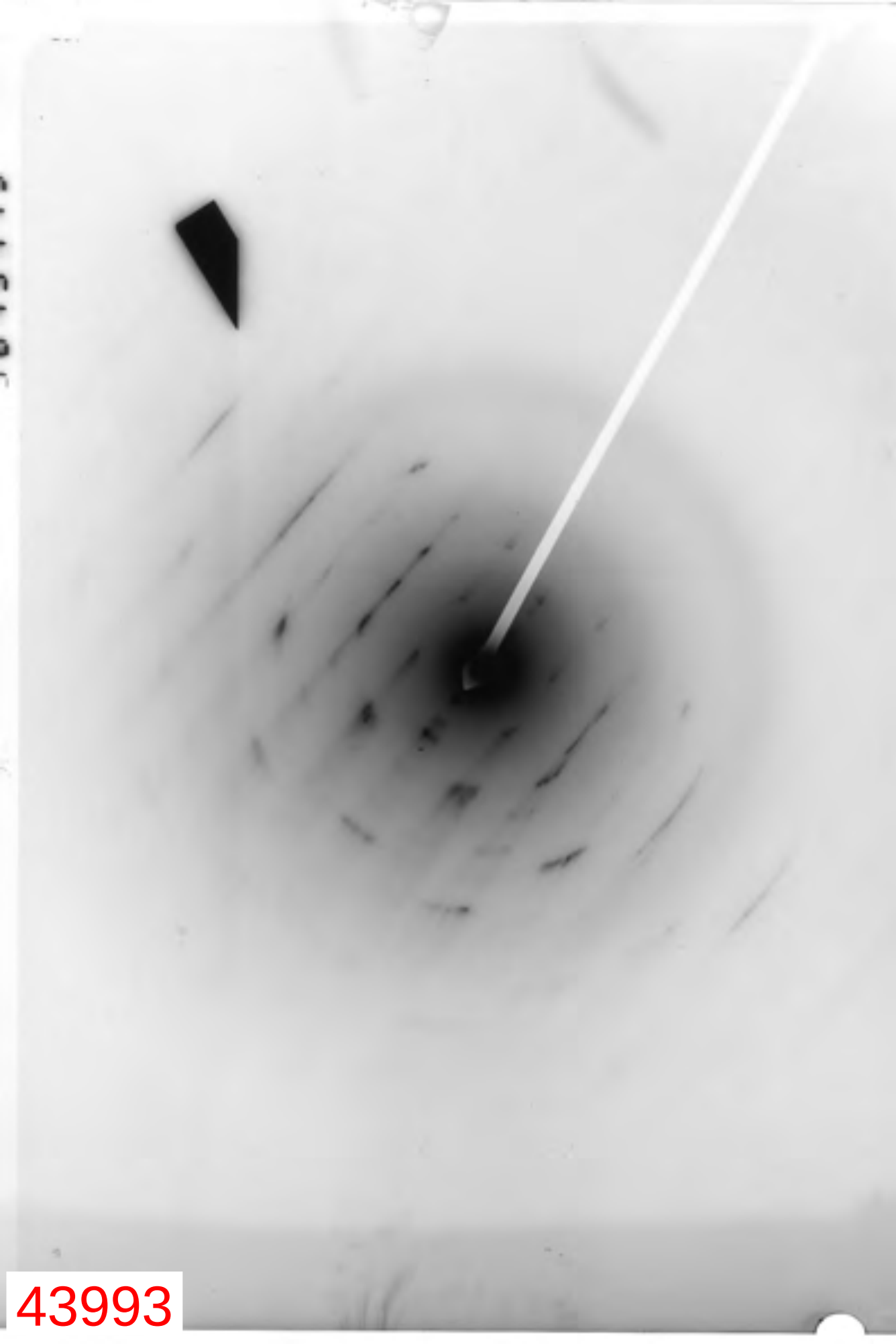
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.29**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	62	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.74**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43993

ISO 10312

TEM Asbestos Count Sheet

11/28/12 DM

EMSL Sample ID:	091211/1943-0073	Volume (L):	1854	Scope:	09-02
Customer Sample:	HM-BG-AA-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	U, 4-6	Analysis Date:	10/11/2012

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	9	none	3:1	5:1	
GO Analyzed:	9				
Level of Analysis Chrysotile:	CDQ	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

11/28/12 DM

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
U4	E1	B	1	1	13.1	1.8	CDQ	CHRYS		44005	YES
U4	E1	MD11	2		11.6	7.5	CD	CHRYS			
U4	E1	MB		2	5.7	0.55	CD	CHRYS			
U4	E3	ND									
U4	E5	ND									
U5	F1	B	3	3	16.2	3.8	CD	CHRYS			
U5	F3	ND									
U5	F5	ND									
U6	F1	B	4	4	12.9	3.2	CD	CHRYS			
U6	F3	B	5	5	8.8	2.4	CD	CHRYS			
U6	F5	MD11	6		21.9	0.8	CD	CHRYS			
U6	F5	MB		6	9.4	0.55	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

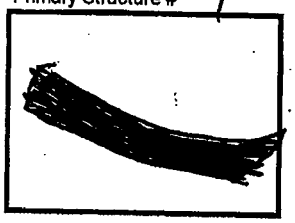
EMSL Order ID: 0912119413-0073

Client:

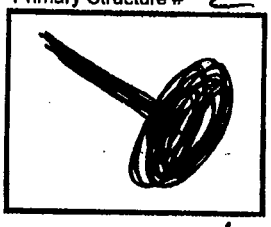
Client Sample:

Page 1 of 1

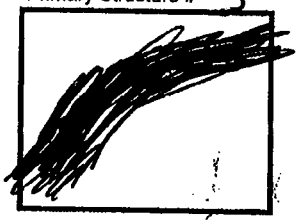
Primary Structure # 1



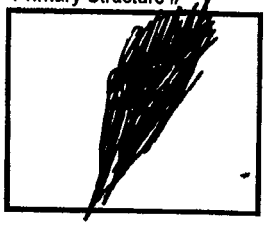
Primary Structure # 2



Primary Structure # 3

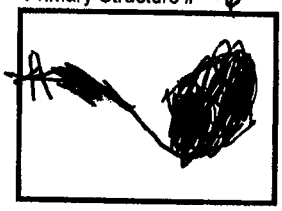


Primary Structure # 4



Primary Structure # 5

Primary Structure # 6



Primary Structure #

Primary Structure #

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Primary Structure #

Structure #

Structure #

Structure #

Structure #

Analyst: KD

Date: 11OCT12

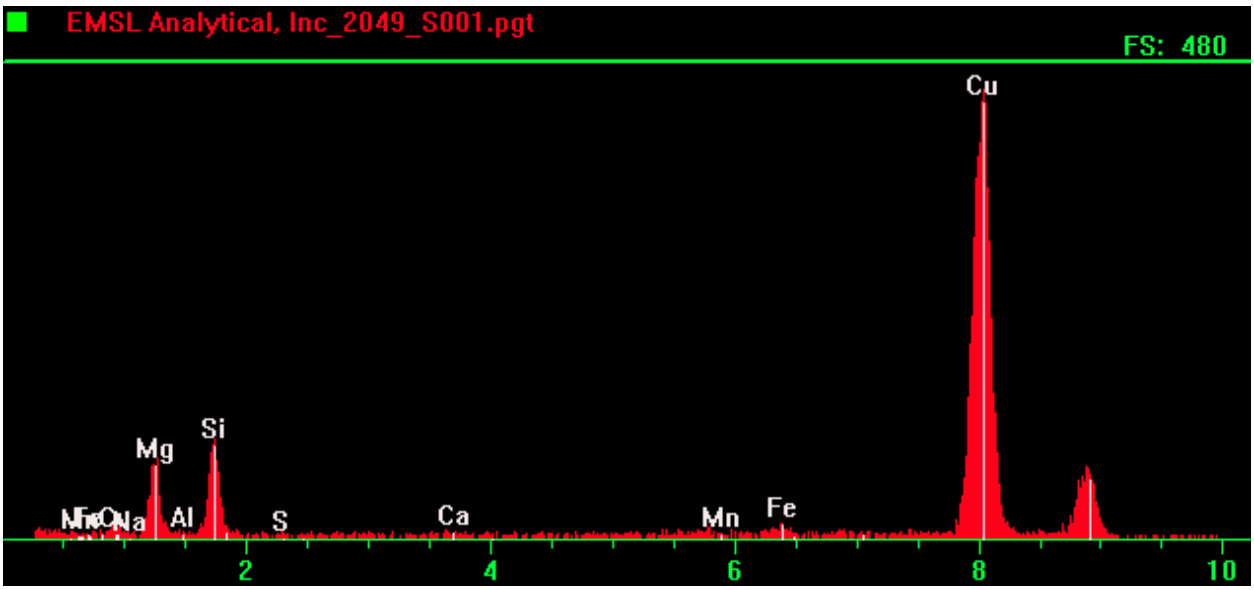
Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0073_TEM_ISO_10312_EDX_Chrysotile
Collected: October 11, 2012 15:47:36

Live Time:	31.64	Count Rate:	915	Dead Time:	11.94 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.0	3.9	0.0	0.0
Mg	KA1	41.5	3.8	37.7	9.9
Al	KA1	4.0	4.6	0.0	0.0
Si	KA1	54.5	4.0	50.6	12.8
S	KA1	2.5	2.5	0.0	0.0
Ca	KA1	4.7	1.9	2.8	1.5
Mn	KA1	4.5	3.4	1.1	0.3
Fe	KA1	10.7	4.6	6.1	1.3
Cu	KA1	414.4	8.6	405.8	47.0

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/17/12

Indexing of negative number: 44005 SCOPE #: 2

Reference / Sample Number: 73

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.55 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.30	mm
Measured distance, center spot to closest hk1 spot (110):	5.25	mm

	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.26**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.25**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.56**	**4.58**	**4.351**	**4.809**

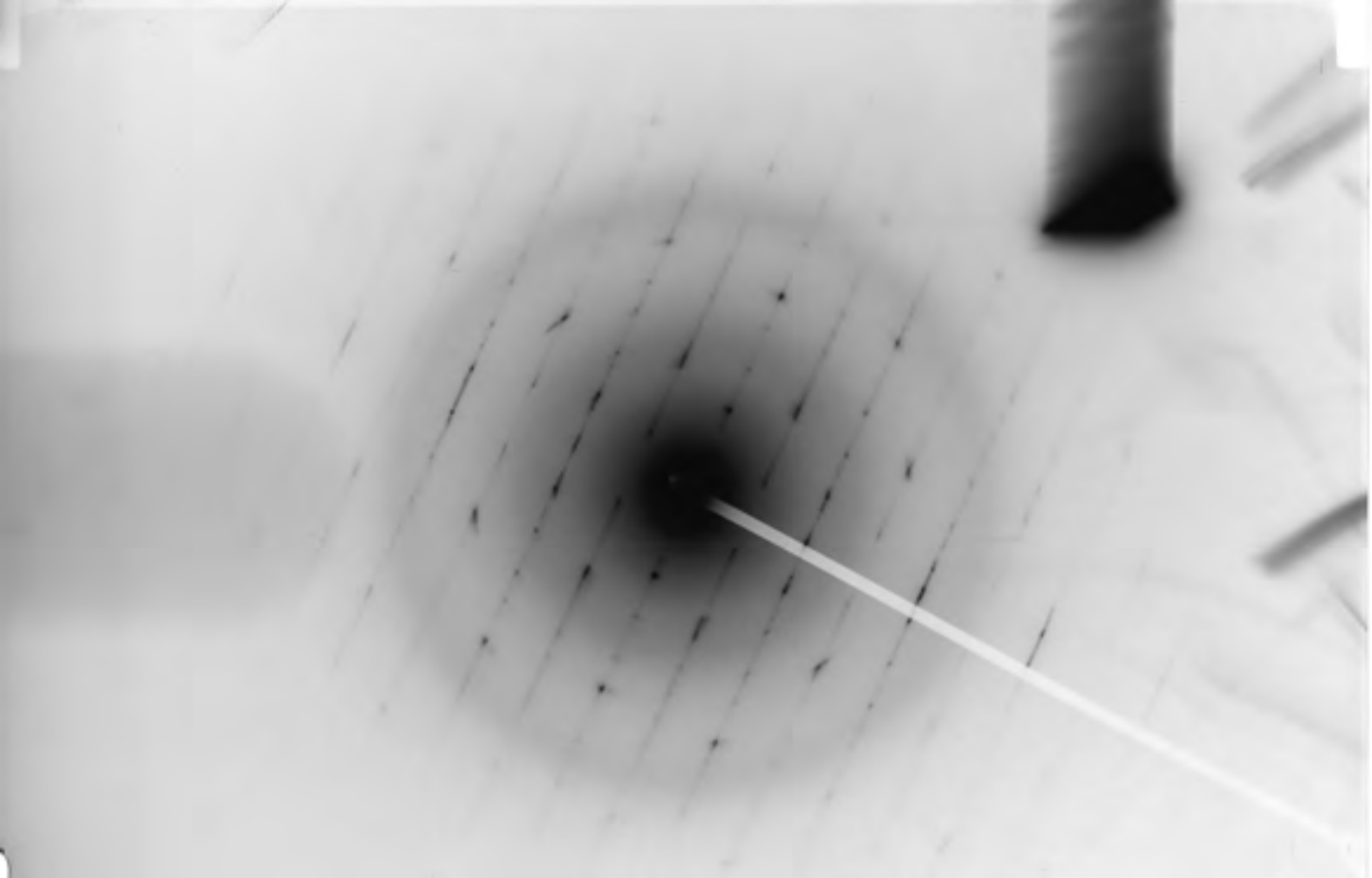
From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____

9844005



ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0074 11/28/12 DM	Volume (L):	1970	Scope:	09-02
Customer Sample:	HM-BG-AA-02	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I003	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	A, 1-3	Analysis Date:	10/11/2012

Analysis Information

Target Sensitivity:	0.002	s/cc	Minimum Aspect Ratio: (circle one)		
GO Required:	8		none	3:1	5:1
GO Analyzed:	8				
Level of Analysis Chrysotile:	CD~~X~~ 11/28/12 DM		Min Length:	> 5	micron
Level of Analysis Amphibole:	ADX		Min Width:	0.25	micron

Comments:

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A1	F1	ND									
A1	F3	ND									
A1	F5	B	1	1	29.55	2	CD	CHRYS		43995	YES
A2	E10	ND									
A2	E8	ND									
A2	E6	ND									
A3	F1	ND									
A3	F3	ND									

ND= None Detected NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 091211943-0074 Client:

Client Sample:

Page 1 of 1

Primary Structure # 1	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Structure #	Structure #	Structure #	Structure #

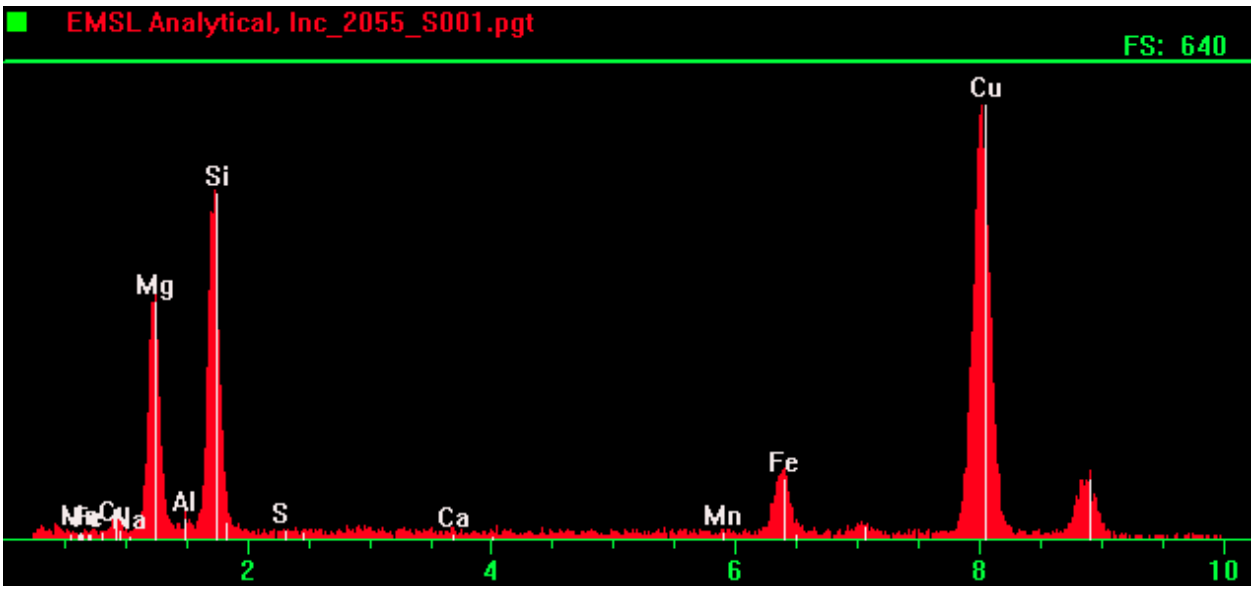
Analyst: KD Date: 11 OCT 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0074_TEM_ISO_10312_EDX_Chrysotile
Collected: October 17, 2012 11:49:39

Live Time:	81.42	Count Rate:	719	Dead Time:	8.67 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	3.0	3.0	0.0	0.0
Mg	KA1	74.2	3.1	71.1	22.9
Al	KA1	6.8	3.4	3.4	1.0
Si	KA1	108.9	3.5	105.3	30.0
S	KA1	3.3	3.0	0.2	0.1
Ca	KA1	3.3	2.7	0.6	0.2
Mn	KA1	3.4	2.6	0.8	0.3
Fe	KA1	30.6	3.2	27.3	8.6
Cu	KA1	200.6	3.4	197.2	58.2

EMSL

CHRYSOTILE SAED INDEXING FORM

EMSL Order ID : 91211943 DATE: 10/16/12

Indexing of negative number: 43995 SCOPE #: 2

Reference / Sample Number: 74

Preliminary ID: Chrysotile By: KD

Using Camera Constant of: 23.93 mm Angstroms

Determined from negative number: 43873

Quick Check

Measured Inter-row spacing: 4.5 mm

110 reflections present? Enter Yes or No y

200 doublets present? Enter Yes or No y

Full Index

Measured distance, center spot to closest hk0 spot (002):	3.25	mm
Measured distance, center spot to closest hk1 spot (110):	5.00	mm

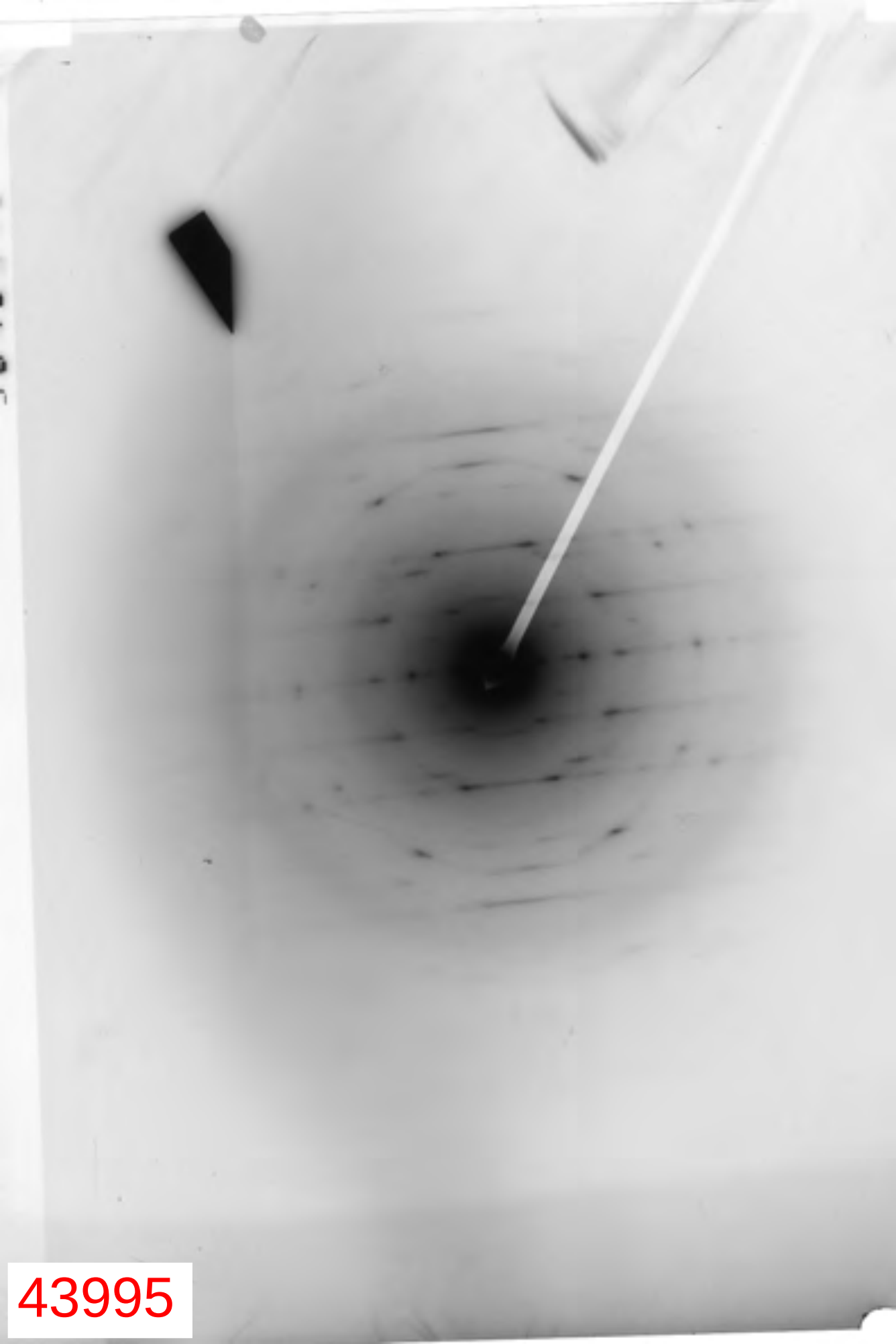
	Calculated	Ref	- 5%	+ 5%
Inter-row spacing (Ångstroms)	**5.32**	**5.30**	**5.035**	**5.565**
Angle to 110 reflection (Measured °)	61	**60**	**57.000**	**63.000**
d2 or d hk 0 (002) (Angstroms)	**7.36**	**7.32**	**6.954**	**7.686**
d1 or d hk 1 (110) (Angstroms)	**4.79**	**4.58**	**4.351**	**4.809**

From SAED Reference Book, "unknown" diffraction pattern was found to be that of: Chrysotile by K. Dunbar

Preliminary Identification was: [x] CORRECT

[ ] INCORRECT

percent accuracy to date: _____



43995

ISO 10312

TEM Asbestos Count Sheet

11/28/12 DM

EMSL Sample ID:	0912117943-0075	Volume (L):	1836	Scope:	09-02
Customer Sample:	HM-BG-AA-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I003	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	A, 4-6	Analysis Date:	10/11/2012

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	9	none	3:1	5:1	
GO Analyzed:	9				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A4	D5	ND									
A4	D7	ND									
A4	D9	ND									
A5	E10	ND									
A5	E8	ND									
A5	E6	ND									
A6	F1	ND									
A6	F3	ND									
A6	F5	ND									

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

11/28/12 DM

EMSL Sample ID:	091211~~1~~943-0076	Volume (L):	0	Scope:	09-02
Customer Sample:	HM-FB	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I003	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	B, 1-3	Analysis Date:	10/11/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	10	none	3:1	5:1	
GO Analyzed:	10				
Level of Analysis Chrysotile:	CD~~Q~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
B1	E10	ND									
B1	E8	ND									
B1	E6	ND									
B2	F1	ND									
B2	F3	ND									
B2	F5	ND									
B2	F7	ND									
B3	F1	ND									
B3	F3	ND									
B3	F5	ND									

ND= None Detected

NAM= Non Asbestos Material

4. QC Data Reports/Logs

Quality Control Report
ISO 10312, ISO 13794, ASTM 6281
-Blanks-

EMSL ANALYTICAL, INC.

	Order ID	Analysis	Blank Type	Analyst	Total Str	No. GO analyzed	GO area	Conc str/mm²	Conclusion*
1	091211943	ISO 10312	Laboratory	KD	0	0	0.0129	None Detected	PASS

*Pass Fail Criteria

Unless Quality Control limits are specified by the client, EMSL will use in-house QC limits published in EMSL's Quality Assurance Manual.

*Air Blanks are considered passing if concentration is <5str/mm²

Quality Control Report
ISO 10312, ISO 13794, ASTM 6281

EMSL ANALYTICAL, INC.

12/12/2012

					Original		QC				
	Order ID	Sample ID	Analysis	QC Type	Analyst	Total Str	Analyst	Total Str.	LCL	UCL	Conclusion*
1	091211943-0001	HM-MS-RS-01	ISO 10312	Inter Analyst	KD	1	BK	1	NA	4.74	PASS
2	091211943-0007	HM-MS-HK-03	ISO 10312	Intra Analyst	KD	2	KD	2	NA	6.3	PASS
3	091211943-0034	HM-AP-AA-03	ISO 10312	Inter Analyst	KD	6	BK	4	2.202	13.06	PASS
4	091211943-0048	HM-OP-HK-04	ISO 10312	Inter Analyst	KD	5	BK	4	1.624	11.67	PASS
5	091211943-0075	HM-BG-AA-03	ISO 10312	Inter Analyst	KD	0	BK	0	NA	2.99	PASS

*Pass Fail Criteria

Unless Quality Control limits are specified by the client, EMSL will use in-house QC limits published in EMSL's Quality Assurance Manual.
Repeat results cannot differ at the 95% confidence interval.

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	**091211943-BLANK**	Volume (L):	NA	Scope:	09-02
Customer Sample:		Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:		Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	D, 5-6	Analysis Date:	10/24/2012

Analysis Information

Target Sensitivity:	s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	15	none	3:1	5:1	
GO Analyzed:	15				
Level of Analysis Chrysotile:	CDØ illasira om	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
D1	E1	None Detected									
D1	E3	None Detected									
D1	E5	None Detected									
D1	E7	None Detected									
D1	E9	None Detected									
D1	F10	None Detected									
D1	F8	None Detected									
D1	F6	None Detected									
D2	E1	None Detected									
D2	E3	None Detected									

ISO 10312

TEM Asbestos Count Sheet

D2	E5	None Detected							
D2	E7	None Detected							
D2	E9	None Detected							
D2	F10	None Detected							
D2	F8	None Detected							
~~D2~~	~~F6~~	~~None Detected~~		11/28/12	JM				

ND= None Detected

NAM= Non Asbestos Material

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0001 QC	Volume (L):	846	Scope:	09-01
Customer Sample:	HM-MS-RS-01	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	BK
EFA (mm^2):	385	Grid Location:	A, 1-2	Analysis Date:	10/23/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	9	none	3:1	5:1	
GO Analyzed:	9				
Level of Analysis Chrysotile:	CD	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A1	F1	None Detected									
A1	F3	None Detected									
A1	F5	None Detected									
A1	F7	None Detected									
A1	F9	B	1	1	37	2.8	CDQ	CHRYS			yes
A2	F3	None Detected									
A2	F5	None Detected									
A2	F7	None Detected									
A2	F9	None Detected									

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 0912119143-0001QC **Client:**

Client Sample:

Page 1 of 1

Primary Structure # 1	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #
Structure #	Structure #	Structure #	Structure #

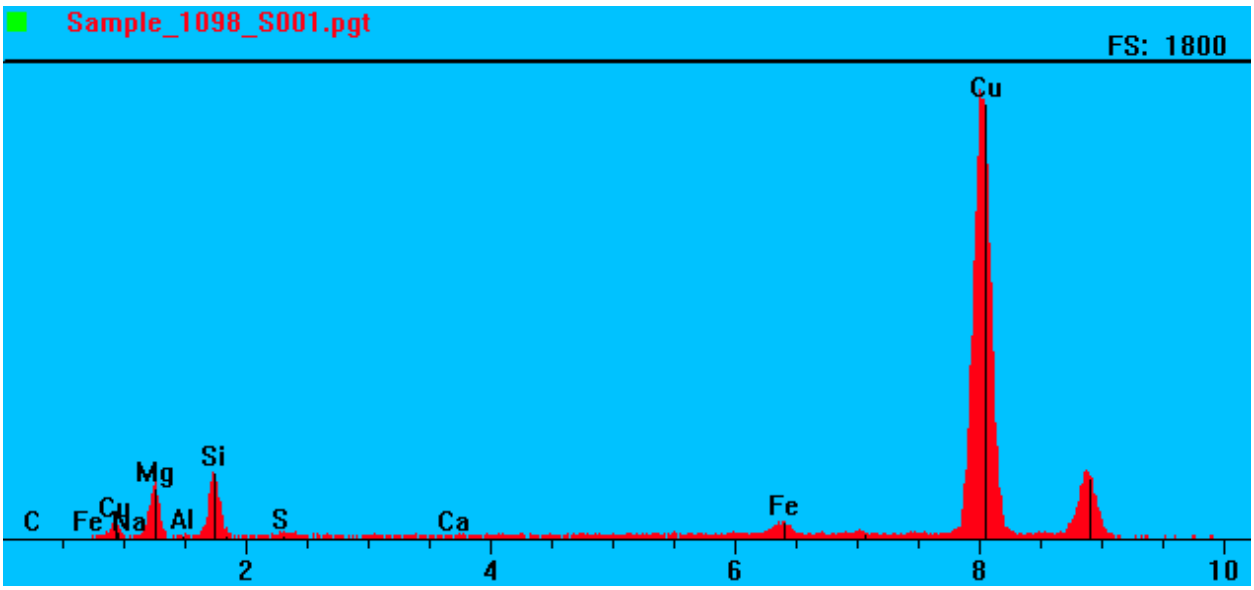
Analyst: BK Date: 10/23/12 Scope: 1

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: C:\Program Files\PGT\Data\Sample_091211943-0001QC_Chry
Collected: October 23, 2012 18:40:22

Live Time:	8.61	Count Rate:	5856	Dead Time:	50.40 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	keV	KRatio	Wt%	At%
C	0.277	0.0000	0.00	0.00
Mg	1.254	0.0144	5.93	13.42
Si	1.740	0.0196	4.26	8.35
Ca	3.691	0.0004	0.04	0.06
Fe	6.403	0.0148	1.07	1.05
Cu	8.046	0.8729	88.35	76.49
S	2.307	0.0017	0.25	0.43
Al	1.487	0.0003	0.09	0.18
Na	1.041	0.0000	0.01	0.01
Total		**0.9241**	**100.00**	**100.00**

Element	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
C	3.3	3.8	0.0	0.0
Mg	210.3	10.9	199.4	18.3
Si	275.0	12.1	262.9	21.8
Ca	19.9	15.8	4.1	0.3
Fe	105.9	30.9	75.0	2.4
Cu	2886.2	34.8	2851.3	81.8
S	32.7	13.0	19.7	1.5
Al	16.3	12.4	3.9	0.3
Na	16.3	8.7	0.1	0.0

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0007(QC)	Volume (L):	671	Scope:	09-02
Customer Sample:	HM-MS-HK-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	KD
EFA (mm^2):	385	Grid Location:	C, 1-2	Analysis Date:	10/24/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	12	none	3:1	5:1	
GO Analyzed:	12				
Level of Analysis Chrysotile:	CDQ illegible	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
C1	D1	None Detected									
C1	D3	None Detected									
C1	D5	B	1	1	10.1	2.8	CDQ	CHRYS		43890	YES
C1	D7	None Detected									
C1	D9	None Detected									
C1	E10	None Detected									
C2	E1	None Detected									
C2	E3	None Detected									
C2	E5	None Detected									
C2	E7	None Detected									
C2	E9	None Detected									
C2	F10	MD11	2		14.6	5	CD	CHRYS			
C2	F10	MB		2	14.6	2	CD	CHRYS			

ND= None Detected

NAM= Non Asbestos Material

TEM ISO 10312

Structure Sketch Sheet

EMSL Order ID: 0912 11943-0007 QC **Client:**

Client Sample:

Page 1 of 1

Primary Structure # 1	Primary Structure # 2	Primary Structure #	Primary Structure #

Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #

Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #

Primary Structure #	Primary Structure #	Primary Structure #	Primary Structure #

Structure #	Structure #	Structure #	Structure #

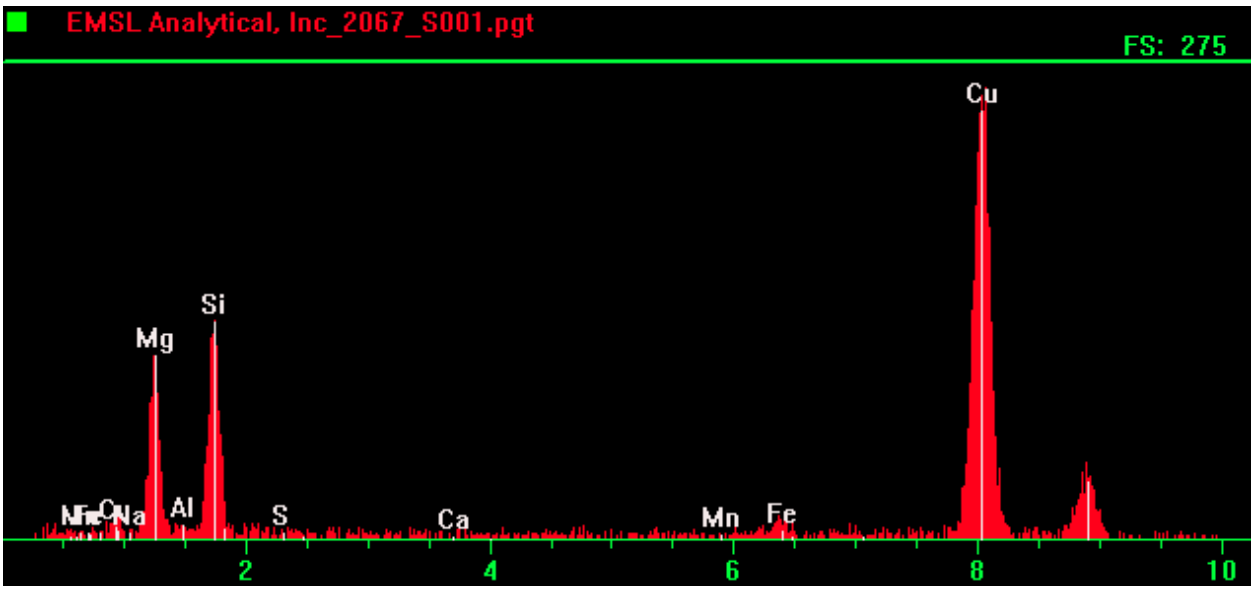
Analyst: KD Date: 24 OCT 12 Scope: Z

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: 091211943-0007_TEM_ISO_10312_EDX_Chrysotile (QC)
Collected: October 24, 2012 15:48:32

Live Time:	36.91	Count Rate:	543	Dead Time:	7.07 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	2.7	2.7	0.0	0.0
Mg	KA1	46.2	2.5	43.7	17.5
Al	KA1	3.9	2.7	1.2	0.5
Si	KA1	61.9	2.2	59.7	27.5
S	KA1	2.1	1.5	0.7	0.5
Ca	KA1	2.3	1.7	0.6	0.4
Mn	KA1	2.3	2.0	0.3	0.2
Fe	KA1	7.5	2.0	5.5	2.8
Cu	KA1	196.0	2.1	193.9	91.7

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	091211943-0034QC	Volume (L):	1925	Scope:	09-0 2
Customer Sample:	HM-AP-AA-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/18/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I001	Analyzed By:	BK
EFA (mm^2):	385	Grid Location:	R, 4-6	Analysis Date:	10/24/2012

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			**Comments:**
GO Required:	8	none	3:1	5:1	
GO Analyzed:	8				
Level of Analysis Chrysotile:	CD~~Ø~~ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures Primary	No. of Structures Total	Dimensions (µm) Length	Dimensions (µm) Width	Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
R4	E10	B	1	1	5.3	0.35	CD	CHRYS			
R4	E10	B	2	2	5	0.45	CD	CHRYS			
R4	E8	ND									
R4	E6	ND									
R5	I1	B	3	3	5.6	0.48	CD	CHRYS			
R5	I1	~~MD~~ ND	~~4~~		~~14.5~~	~~4~~			11/28/12 DM		
R5	I1	~~MB~~ ND		~~4~~	~~5.8~~	~~0.1~~	CD	CHRYS	Too thin ~~to count?~~	11/28/12 DM	
R5	I3	ND									
R5	I5	ND									
R6	F3	ND									
R6	F5	B	4 ~~5~~	4 ~~5~~	42	5	CD	CHRYS			

ND= None Detected 11/28/12 DM

NAM= Non Asbestos Material

TEM ISO 10312

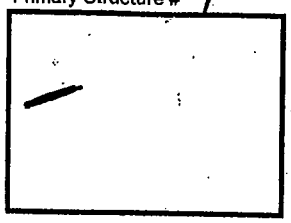
Structure Sketch Sheet

EMSL Order ID: 09121943-0034QC **Client:**

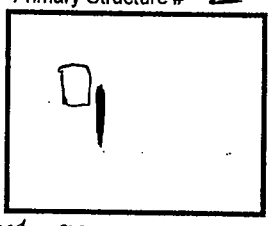
Client Sample:

Page 1 of 1

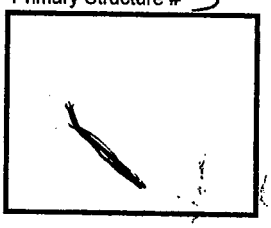
Primary Structure # 1



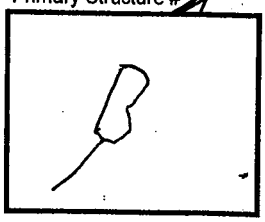
Primary Structure # 2



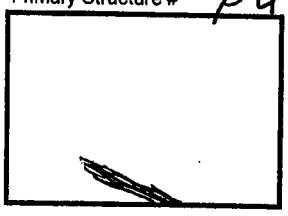
Primary Structure # 3



Primary Structure # ~~4~~ 11/28/12 DM



Primary Structure # ~~5~~ 4 11/28/12 DM



Primary Structure #

Primary Structure #

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Structure #

Analyst: BK

Date: 10/24/12

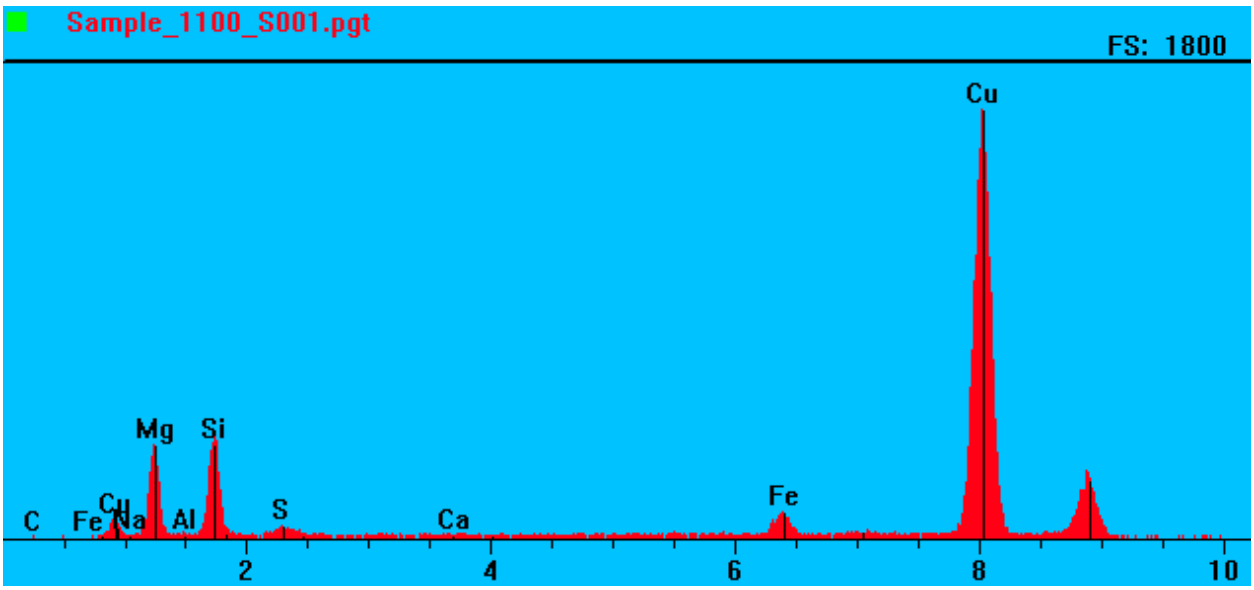
Scope: 1

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: C:\Program Files\PGT\Data\Sample_091211943-0034_CHRY
Collected: October 24, 2012 17:48:05

Live Time:	17.84	Count Rate:	2981	Dead Time:	29.87 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	keV	KRatio	Wt%	At%
C	0.277	0.0000	0.00	0.00
Mg	1.254	0.0236	9.57	20.04
Si	1.740	0.0303	6.58	11.92
Ca	3.691	0.0004	0.04	0.05
Fe	6.403	0.0241	1.79	1.63
Cu	8.046	0.7970	81.33	65.18
S	2.307	0.0034	0.50	0.80
Al	1.487	0.0003	0.10	0.19
Na	1.041	0.0001	0.08	0.18
Total		**0.8793**	**100.00**	**100.00**

Element	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
C	2.7	2.5	0.0	0.0
Mg	170.9	7.0	163.9	23.4
Si	210.7	8.7	202.0	23.1
Ca	12.0	10.1	1.9	0.2
Fe	73.8	13.4	60.4	4.5
Cu	1304.2	16.8	1287.4	76.6
S	29.9	9.8	20.1	2.0
Al	10.5	8.1	2.3	0.3
Na	11.1	6.1	1.0	0.2

ISO 10312

TEM Asbestos Count Sheet

EMSL Sample ID:	0912111943-0048 QC 11/28/12 DM	Volume (L):	726	Scope:	09-02
Customer Sample:	HM-OP-HK-04	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I002	Analyzed By:	BK
EFA (mm^2):	385	Grid Location:	E, 4-6	Analysis Date:	10/25/2012

Analysis Information

Target Sensitivity:	0.004 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	11	none	3:1	5:1	
GO Analyzed:	11				
Level of Analysis Chrysotile:	CDQ 11/28/12 DM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
E4	F3	B	1	1	13	2.5	CD	CHRYS			
E4	F3	B	2	2	7.6	1.2	CD	CHRYS			
E4	F5	ND									
E4	F7	ND									
E4	F9	B	3	3	6.5	0.98	CD	CHRYS			
E5	F7	B	4	4	38	4.5	CDQ	CHRYS			yes
E5	F5	ND									
E5	F3	ND									
E5	F1	ND									
E6	E10	~~B~~ ND	~~5~~	~~5~~	~~8.4~~	~~0.1~~	CD	CHRYS	Too thin to count?	11/28/12 DM	
E6	E8	ND									
E6	E6	ND									

ND= None Detected NAM= Non Asbestos Material

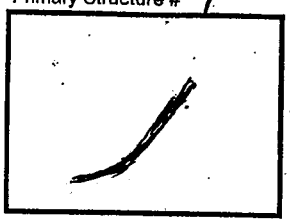
TEM ISO 10312

Structure Sketch Sheet

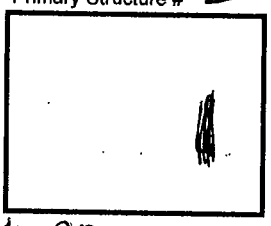
EMSL Order ID: 0912119 43-0048QC **Client:**

Client Sample: _____ Page 1 of _____

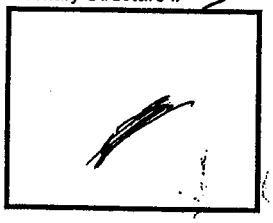
Primary Structure # 1



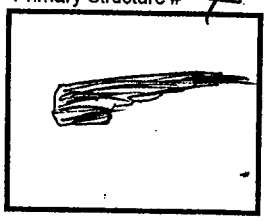
Primary Structure # 2



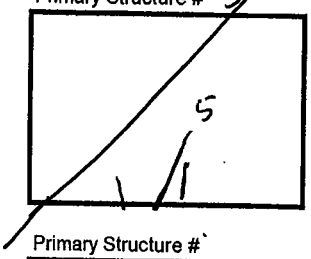
Primary Structure # 3



Primary Structure # 4



Primary Structure # 5 11/28/12 DM



Primary Structure #

Primary Structure #

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Structure #

Structure #

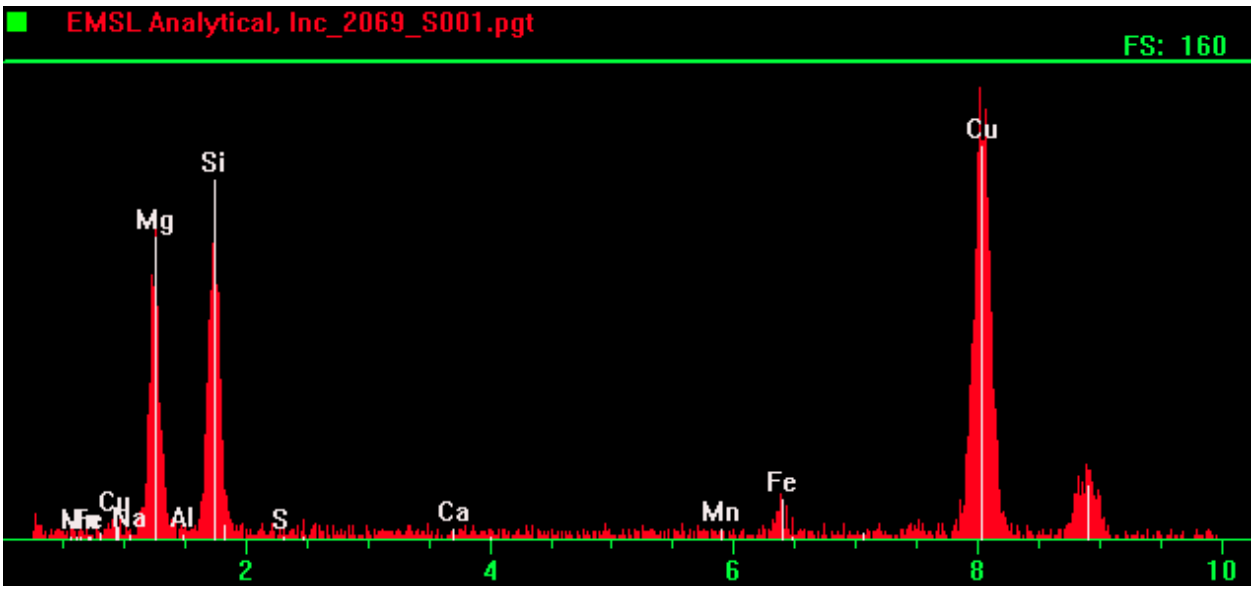
Analyst: BK Date: 10/25/12 Scope: 2

Energy Dispersive X-Ray Analysis
Quantitative Spectra & Data

EMSL ANALYTICAL, INC.

File: C:\Program Files\PGT\Data\EMSL Analytical, Inc_091211943-0048-QC_Chry
Collected: October 25, 2012 10:44:07

Live Time:	33.89	Count Rate:	406	Dead Time:	5.26 %
Beam Voltage:	20.00	Beam Current:	2.00	Takeoff Angle:	31.00



Element	Line	Gross (cps)	BKG (cps)	Net (cps)	P:B Ratio
Na	KA1	2.0	1.4	0.3	0.2
Mg	KA1	49.3	2.2	47.2	21.6
Al	KA1	2.5	2.3	0.2	0.1
Si	KA1	61.3	1.7	59.6	35.5
S	KA1	2.0	0.8	1.2	1.5
Ca	KA1	1.4	0.9	0.5	0.6
Mn	KA1	1.7	1.1	0.6	0.6
Fe	KA1	7.4	1.1	6.3	6.0
Cu	KA1	119.9	2.3	117.6	51.1

ISO 10312

TEM Asbestos Count Sheet

11/28/12 DJM

EMSL Sample ID:	091211~~1~~943-0075	Volume (L):	1836	Scope:	09-02
Customer Sample:	HM-BG-AA-03	Prepped By:	PK	GO area (mm2):	0.0129
Sample Description:	AIR	Prepped Date:	9/19/2012	Magnification:	19 KX
Pore Size (micron):	0.45	Grid Box :	12I003	Analyzed By:	BK
EFA (mm^2):	385	Grid Location:	A, 4-6	Analysis Date:	10/25/2012

Analysis Information

Target Sensitivity:	0.002 s/cc	Minimum Aspect Ratio: (circle one)			***Comments:***
GO Required:	9	none	3:1	5:1	
GO Analyzed:	9				
Level of Analysis Chrysotile:	CDQ 11/28/12 DJM	Min Length:	> 5	micron	
Level of Analysis Amphibole:	ADX	Min Width:	0.25	micron	

Grid	Grid Opening	Structure Type	No. of Structures		Dimensions (µm)		Level of ID	Mineral Type	Sketch Comments	Photo Number	EDXA Printed
			Primary	*Total*	*Length*	*Width*					
A4	D5	ND									
A4	D7	ND									
A4	D9	ND									
A5	E10	ND									
A5	E8	ND									
A5	E6	ND									
A6	F1	ND									
A6	F3	~~MD~~ ND	~~1~~		~~12.6~~	~~4.2~~			11/28/12 DJM		
A6	F3	~~B~~ ND		~~1~~	~~5.02~~	~~0.15~~	~~CDQ~~		Too thin to count?	11/28/12 DJM	
A6	F5	ND									

ND= None Detected

NAM= Non Asbestos Material

5. Client and EMSL Internal Chains of Custody

Chain of Custody

EMSL Order Number (*Lab Use Only*): 09 R11943

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Company: ERRG	**EMSL-Bill to:** ☐ Same ☒ Different If Bill to is Different note instructions in Comments** Third Party Billing requires written authorization from third party
Street: 115 Sansome ST Ste 200	
City: San Francisco **State/Province:** CA	**Zip/Postal Code:** 94104 **Country:** USA
Report To (Name): Samantha Knight	**Fax #:**
Telephone #: 415 848 7100	**Email Address:** Samantha.Knight@eng.com
Project Name/Number: 2011-179	
Please Provide Results: ☐ Fax ☒ Email	**Purchase Order:** **U.S. State Samples Taken:** CA

Turnaround Time (TAT) Options* - Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☒ 2 Week

**For RUSH TAT's Please Call Ahead to Confirm Lab Hours and Availability. Not all TAT options are valid for every test. Materials Science and IAQ TATs are in Business Days rather than Hours (i.e. 24 Hour = End of Next Business Day)*

Asbestos

PCM - Air
- ☐ NIOSH 7400
- ☐ w/ 8hr. TWA

TEM– Air ☐ 4-4.5hr TAT (AHERA ONLY)
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☒ ISO 10312

TEM - Water
- Fibers ≥10µm ☐ Waste ☐ Drinking
- All Fiber Sizes ☐ Waste ☐ Drinking

PLM - Bulk
- ☐ PLM EPA 600/R-93/116
- ☐ PLM EPA NOB (<1%)
- ☐ NYS 198.1 (friable-NY)
- ☐ NYS 198.6 (non-friable-NY)
- Point Count ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- Point Count w/ Gravimetric ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

TEM - Dust
- ☐ Microvac – ASTM D 5755
- ☐ Wipe-ASTM D6480

TEM - Bulk
- ☐ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ Chatfield SOP

Soil/Rock/Vermiculite
- ☐ PLM CARB 435 – A (0.25% sensitivity)
- ☐ PLM CARB 435 – B (0.1% sensitivity)
- ☐ TEM CARB 435 – B (0.1% sensitivity)
- ☐ EPA Reg. 1 Screening Protocol (Qualitative)

Other:

Lead (Pb)

Flame Atomic Absorption
- ☐ Chips SW846-7000B or AOAC 974.02
- ☐ Soil SW846-7000B/7420
- ☐ Air NIOSH 7082
- ☐ Wastewater SM3111B or SW846-7000B/7420
- ☐ ASTM Wipe SW846-7000B/7420
- ☐ non ASTM Wipe SW846-7000B/7420
- ☐ TCLP SW846-1311/7420/SM 3111B

ICP
- ☐ Air NIOSH 7300 Modified
- ☐ non ASTM Wipe SW846-6010B or C
- ☐ ASTM Wipe SW846-6010B or C
- ☐ Soil SW846-6010 B or C
- ☐ Waste Water SW846-6010B or C
- ☐ TCLP SW846-6010B or C

Graphite Furnace Atomic Absorption
- ☐ Soil SW846-7421 ☐ Wastewater EPA 200.9
- ☐ Air NIOSH 7105 ☐ Drinking Water EPA 200.9

Other: ☐

Materials Science

- ☐ Common Particle ID (large particles)
- ☐ Full Particle ID (environmental dust)
- ☐ Basic Material ID (solids)
- ☐ Advanced Material ID
- ☐ Physical Testing (Tensile, Compression)
- ☐ Combustion-by-products (soot, char, etc.)
- ☐ X-Ray Fluorescence (elem. analysis)
- ☐ X-Ray Diffraction (Crystalline Part.)
- ☐ MMVF's (Fibrous glass, RCF's)
- ☐ Particle Size (sieve/microscopy/laser)
- ☐ Combustible Dust
- ☐ Petrographic Examination

Other: ☐

Microbiology

Wipe and Bulk Samples
- ☐ Mold & Fungi – Direct Examination
- ☐ Mold & Fungi Culture (Genus Only)
- ☐ Mold & Fungi Culture (Genus & Species)
- ☐ Bacterial Count & ID (Up to Three Types)
- ☐ Bacterial Count & ID (Up to Five Types)
- ☐ MRSA
- ☐ *Pseudomonas aeruginosa*

Water Samples
- ☐ Total Coliform & E.coli (P/A)
- ☐ Fecal Coliform (SM 9222D)
- ☐ Sewage Screen
- ☐ Heterotrophic Plate Count (SM 9215)

Air Samples
- ☐ Mold & Fungi (Spore Trap)
- ☐ Mold & Fungi Culture (Genus Only)
- ☐ Mold & Fungi (Genus & Species)
- ☐ Bacterial Culture & ID (Up to Three Types)
- ☐ Bacterial Culture & ID (Up to Five Types)
- ☐ Endotoxin Testing

Real Time Q-PCR (See Analytical Guide for Code)
Code:

Legionella
☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 4

Other: ☐

IAQ

- Nuisance Dust NIOSH ☐ 0500 ☐ 0600
- Airborne Dust ☐ PM10 ☐ TSP
- Silica Analysis: ☐ All Species
- Silica Analysis – Single Species
  - ☐ Alpha Quartz ☐ Cristobalite ☐ Tridymite
- ☐ HVAC Efficiency
- ☐ Carbon Black
- ☐ Airborne Oil Mist
- Radon Testing: Call for Kit and COC

Other: ☐

****Comments/Special Instructions:**
Billing Address: ERRG 4585 Pacheco Blvd, Ste 200, Martinez CA 94553

Client Sample #'s		**Total # of Samples:**	
Relinquished (Client):	**Date:** 9/17/12	**Time:**	11:03
Received (Lab):	**Date:** 9-17-12	**Time:**	11:05 AM PD

Analysis Completed in Accordance with EMSL's Terms and Conditions located in the Analytical Price Guide

Chain of Custody

EMSL Order Number *(Lab Use Only)*: 0912119C3

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
HM-MS-RS-01		846 ~~576~~ L	9/4/12 1930
HM-MS-RS-02		798 L	9/4/12 1930
HM-MS-RS 03		609 L	9/4/12 1930
HM-MS-RS-04		860 L	9/4/12 1930
HM-MS-HK-01		708 L	9/5/12 1210
HM-MS-HK-02		705 L	9/5/12 1210
HM-MS-HK-03		671 L	9/5/12 1210
HM-MS-HK-04		713 L	9/5/12 1210
HM-MS-ATV-01		646 L	9/5/12 1920
HM-MS-ATV-02		630 L	9/5/12 1920
HM-MS-ATV-03		722 L	9/5/12 1920
HM-MS-ATV-04		704 L	9/5/12 1920
HM-MS-ATV-05		723 L	9/5/12 1920
HM-MS-MB-BK-01		544 L	9/9/12 1130
HM-MS-MB-BK-02		580 L	9/9/12 1130
HM-MS-MB-BK-03		688 L	9/9/12 1130

***Comments/Special Instructions:**

Received at EMSL Analytical, Inc.
San Leandro, CA (888) 455-3675
By: [illegible]
Date: 9-17-12 11:05 am/pm

Analysis Completed in Accordance with EMSL's Terms and Conditions located in the Analytical Price Guide

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Chain of Custody

EMSL Order Number *(Lab Use Only)*: 0911211943

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
HM-MS-MB-04		675 L	9/9/12 1130
HM-MS-AA-05		1,717 L	9/9/12 1130
HM-MS-AA-06		1,694 L	9/9/12 1130
HM-AP-ATV-01		595 L	9/6/12 1220
HM-AP-ATV-02		660 L	9/6/12 1220
HM-AP-ATV-03		568 L	9/6/12 1220
HM-AP-ATV-04		662 L	9/6/12 1130
HM-AP-MB-01		792 L	9/10/12 1145
HM-AP-MB-02		786 L	9/10/12 1145
HM-AP-MB-03		~~600~~ 730 L	9/10/12 1145
HM-AP-MB-04		705 L	9/10/12 1145
HM-AP-MB-05		600 L	9/10/12 1145
HM-~~HK~~ AP-HK-01		710 L	9/10/12 1715
HM-AP-HK-02		707 L	9/10/12 1715
HM-AP-HK-03		668 L	9/10/12 1715
HM-AP-HK-04		685 L	9/10/12 1715

***Comments/Special Instructions:**

Received at EMSL Analytical, Inc.
San Leandro, CA (888) 455-3675
By: [illegible]
Date: 11/9/12 11:25 am/pm

AM
PO

Analysis Completed in Accordance with EMSL's Terms and Conditions located in the Analytical Price Guide

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Chain of Custody

EMSL Order Number *(Lab Use Only)*: 0912119413

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
HM-AP-HK-05		735 L	9/10/12 1715
HM-AP-AA-03		1,925 L	9/10/12 1715
HM-AP-AA-04		1,919 L	9/10/12 1715
HM-OP-ATV-01		673 L	9/7/12 1110
HM-OP-ATV-02		616 L	9/7/12 1110
HM-OP-ATV-03		695 L	9/7/12 1110
HM-OP-ATV-04		736 L	9/7/12 1110
HM-OP-ATV-05		694 L	9/7/12 1110
HM-OP-MB-01		733 L	9/7/12 1250
HM-OP-MB-02		696 L	9/7/12 1250
HM-OP-MB-03		726 L	9/7/12 1250
HM-OP-MB-04		768 L	9/7/12 1250
HM-OP-HK-01		726 L	9/7/12 1820
HM-OP-HK-02		772 L	9/7/12 1820
HM-OP-HK-03		717 L	9/7/12 1820
HM-OP-HK-04		726 L	9/7/12 1820

*Comments/Special Instructions:

Received at EMSL Analytical, Inc.
San Leandro, CA (888) 455-3675
By:
Date: 9-17-12 Time: 3:15pm

Analysis Completed in Accordance with EMSL's Terms and Conditions located in the Analytical Price Guide

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Chain of Custody

EMSL Order Number *(Lab Use Only)*: 09121943

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
HM-BG-HK-01		733 L	9/11/12 1900
HM-BG-HK-02		810 L	9/11/12 1900
HM-BG-HK-03		724 L	9/11/12 1900
HM-BG-HK-04		763 L	9/11/12 1900
HM-BG-RS-01		705 L	9/12/12 1245
HM-BG-RS-02		705 L	9/12/12 1245
HM-BG-RS-03		684 L	9/12/12 1245
HM-BG-RS-04		678 L	9/12/12 1245
HM-BG-AA-01		1,854 L	9/11/12 1830
HM-BG-AA-02		1,970 L	9/11/12 1830
HM-BG-AA-03		1,836 L	9/11/12 1830
HM-FB		Q	—
	SG 9/17/12		

*Comments/Special Instructions:

Received at EMSL Analytical, Inc.
San Leandro, CA (888) 455-3675
By
Date 9/17/12 Time 11:05 am pm AM

Analysis Completed in Accordance with EMSL's Terms and Conditions located in the Analytical Price Guide

EMSL ANALYTICAL, INC.
LABORATORY • PRODUCTS • TRAINING

Chain of Custody

EMSL Order Number *(Lab Use Only)*: 091211943

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
HM-OP-HK-05		654 L	9/7/12 1820
HM-OP-RS-01		760 L	9/11/12 1015
HM-OP-RS-02		737 L	9/11/12 1015
HM-OP-RS-03		735 L	9/11/12 1015
HM-OP-RS-04		797 L	9/11/12 1015
HM-OP-RS-05		723 L	9/11/12 1015
HM-OP-AA-01		1,589 L	9/7/12 1810
HM-OP-AA-02		1,657 L	9/7/12 1810
HM-BG-ATV-01		720 L	9/9/12 1715
HM-BG-ATV-02		582 L	9/9/12 1715
HM-BG-ATV-03		615 L	9/9/12 1715
HM-BG-ATV-04		660 L	9/9/12 1715
HM-BG-MB-01		765 L	9/11/12 1530
HM-BG-MB-02		758 L	9/11/12 1530
HM-BG-MB-03		693 L	9/11/12 1530
HM-BG-MB-04		684 L	9/11/12 1530

*Comments/Special Instructions:

Received at EMSL Analytical, Inc.
San Leandro, CA (888) 455-3675
By
Date 11/9/12 10:35 AM am pm

Analysis Completed in Accordance with EMSL's Terms and Conditions located in the Analytical Price Guide

INTERNAL CHAIN OF CUSTODY

Order ID: 091211943 *9/17/2012 12:35:19 PM*

Attn: SAMANTHA KNIGHT
Engineering/Remediation Resources Group
115 Sansome Street
Suite 200
San Francisco, CA 94104
Fax: (415) 395-9983 Phone: (415) 848-7100
Project: **2011-119**

Customer ID: ERRG25A
Customer PO: 2011-119
Received: 09/07/12 11:00 AM

EMSL Order: 091211943
EMSL Proj ID:
Cust COC ID

Invoice to Engineering/Remediation Resources Group (ERRG25), 4585 Pacheco Blvd
Suite 200, Martinez, CA 94553

REPORT TO INSTRUCTIONS

- [x] Send Receipt Confirmation Emails
- [ ] Email Report Only-Do not send hard copy
- [ ] No electronic signatures
- [ ] Project ID required
- [ ] Cust. COC ID required
- [ ] Miscellaneous account

Sales Rep and Comment: imurdock

Instructions

BILL TO INSTRUCTIONS

- [ ] Exempt from prep charge
- [ ] Exempt from off hour min charges
- [ ] Exempt from layer/aliquot charges
- [ ] Email Invoice Only- Do not send hard copy.
- [ ] Credit Card on File
- [ ] P.O. Required

Billing Frequency: --

Use Billing Contact:
Accounting Terms: N30
Payment Directions:

Instructions

Internal Comment

Test: TEM ISO 10312 **Matrix** Air **TAT:** 2 Week **Qty:** 76

- [ ] Lab Opening Exempt For Test
- [ ] Prep Charge Exempt For Test
- [ ] Layer/Aliquot Charge Exempt For Test

Logged: tlanzing **Date:** 9/17/2012
Sample Condition: [x] Acceptable [ ] Unacceptable

Comments See Attached sheet for grid info.

Like Ahra
put 3 grids per sample (no 3rd prep storage)
separate box

Prepped: PK **Date:** 9/24/12
Analyzed: KD **Date:** 185ept12
Data Entry **Date:**
Screened: **Date:**
Mailed: DM **Date:** 12/17/12

Special Test Instructions

Lab Sample #	Cust. Sample #	Location	Due Date
091211943-0001	HM-MS RS-01		9/21/2012 11:00:00 AM
091211943-0002	HM-MS RS-02		9/21/2012 11:00:00 AM
091211943-0003	HM-MS RS-03		9/21/2012 11:00:00 AM
091211943-0004	HM-MS RS-04		9/21/2012 11:00:00 AM
091211943-0005	HM-MS HK-01		9/21/2012 11:00:00 AM
091211943-0006	HM-MS HK-02		9/21/2012 11:00:00 AM
091211943-0007	HM-MS HK-03 BP & BA	SA	9/21/2012 11:00:00 AM

INTERNAL CHAIN OF CUSTODY

Order ID: 091211943 *12/16/2012 4:56:24 PM*

Attn: SAMANTHA KNIGHT
Engineering/Remediation Resources Group
115 Sansome Street
Suite 200
San Francisco, CA 94104
Fax: (415) 395-9983 Phone: (415) 848-7100
Project: **2011-119**

Customer ID: ERRG25A
Customer PO: 2011-119
Received: 09/07/12 11:00 AM

EMSL Order: 091211943
EMSL Proj ID:
Cust COC ID

Invoice to Engineering/Remediation Resources Group (ERRG25), 4585 Pacheco Blvd
Suite 200, Martinez, CA 94553

091211943-0008	HM-MS HK-04	11/15/2012 11:00:00 AM
091211943-0009	HM-MS ATV-01	11/15/2012 11:00:00 AM
091211943-0010	HM-MS ATV-02	11/15/2012 11:00:00 AM
091211943-0011	HM-MS ATV-03	11/15/2012 11:00:00 AM
091211943-0012	HM-MS ATV-04	11/15/2012 11:00:00 AM
091211943-0013	HM-MS ATV-05	11/15/2012 11:00:00 AM
091211943-0014	HM-MS MB-01	11/15/2012 11:00:00 AM
091211943-0015	HM-MS MB-02	11/15/2012 11:00:00 AM
091211943-0016	HM-MS MB-03	11/15/2012 11:00:00 AM
091211943-0017	HM-MS MB-04	11/15/2012 11:00:00 AM
091211943-0018	HM-MS AA-05	11/15/2012 11:00:00 AM
091211943-0019	HM-MS AA-06	11/15/2012 11:00:00 AM
091211943-0020	HM-AP ATV-01	11/15/2012 11:00:00 AM
091211943-0021	HM-AP ATV-02	11/15/2012 11:00:00 AM
091211943-0022	HM-AP ATV-03	11/15/2012 11:00:00 AM
091211943-0023	HM-AP ATV-04	11/15/2012 11:00:00 AM
091211943-0024	HM-AP MB-01	11/15/2012 11:00:00 AM
091211943-0025	HM-AP MB-02	11/15/2012 11:00:00 AM
091211943-0026	HM-AP MB-03	11/15/2012 11:00:00 AM
091211943-0027	HM-AP MB-04	11/15/2012 11:00:00 AM
091211943-0028	HM-AP MB-05	11/15/2012 11:00:00 AM
091211943-0029	HM-AP HK-01	11/15/2012 11:00:00 AM
091211943-0030	HM-AP HK-02	11/15/2012 11:00:00 AM
091211943-0031	HM-AP HK-03	11/15/2012 11:00:00 AM
091211943-0032	HM-AP HK-04	11/15/2012 11:00:00 AM
091211943-0033	HM-AP HK-05	11/15/2012 11:00:00 AM
091211943-0034	HM-AP AA-03	11/15/2012 11:00:00 AM
091211943-0035	HM-AP AA-04	11/15/2012 11:00:00 AM
091211943-0036	HM-OP ATV-01	11/15/2012 11:00:00 AM
091211943-0037	HM-OP ATV-02	11/15/2012 11:00:00 AM
091211943-0038	HM-OP ATV-03	11/15/2012 11:00:00 AM
091211943-0039	HM-OP ATV-04	11/15/2012 11:00:00 AM
091211943-0040	HM-OP ATV-05	11/15/2012 11:00:00 AM
091211943-0041	HM-OP MB-01	11/15/2012 11:00:00 AM
091211943-0042	HM-OP MB-02	11/15/2012 11:00:00 AM

INTERNAL CHAIN OF CUSTODY

Order ID: 091211943 *12/16/2012 4:56:24 PM*

Attn: SAMANTHA KNIGHT
Engineering/Remediation Resources Group
115 Sansome Street
Suite 200
San Francisco, CA 94104
Fax: (415) 395-9983 Phone: (415) 848-7100
Project: **2011-119**

Customer ID: ERRG25A
Customer PO: 2011-119
Received: 09/07/12 11:00 AM

EMSL Order: 091211943
EMSL Proj ID:
Cust COC ID

Invoice to Engineering/Remediation Resources Group (ERRG25), 4585 Pacheco Blvd
Suite 200, Martinez, CA 94553

091211943-0043	HM-OP MB-03	11/15/2012 11:00:00 AM
091211943-0044	HM-OP MB-04	11/15/2012 11:00:00 AM
091211943-0045	HM-OP HK-01	11/15/2012 11:00:00 AM
091211943-0046	HM-OP HK-02	11/15/2012 11:00:00 AM
091211943-0047	HM-OP HK-03	11/15/2012 11:00:00 AM
091211943-0048	HM-OP HK-04	11/15/2012 11:00:00 AM
091211943-0049	HM-OP HK-05	11/15/2012 11:00:00 AM
091211943-0050	HM-OP RS-01	11/15/2012 11:00:00 AM
091211943-0051	HM-OP RS-02	11/15/2012 11:00:00 AM
091211943-0052	HM-OP RS-03	11/15/2012 11:00:00 AM
091211943-0053	HM-OP RS-04	11/15/2012 11:00:00 AM
091211943-0054	HM-OP RS-05	11/15/2012 11:00:00 AM
091211943-0055	HM-OP AA-01	11/15/2012 11:00:00 AM
091211943-0056	HM-OP AA-02	11/15/2012 11:00:00 AM
091211943-0057	HM-BG ATV-01	11/15/2012 11:00:00 AM
091211943-0058	HM-BG ATV-02	11/15/2012 11:00:00 AM
091211943-0059	HM-BG ATV-03	11/15/2012 11:00:00 AM
091211943-0060	HM-BG ATV-04	11/15/2012 11:00:00 AM
091211943-0061	HM-BG MB-01	11/15/2012 11:00:00 AM
091211943-0062	HM-BG MB-02	11/15/2012 11:00:00 AM
091211943-0063	HM-BG MB-03	11/15/2012 11:00:00 AM
091211943-0064	HM-BG MB-04	11/15/2012 11:00:00 AM
091211943-0065	HM-BG HK-01	11/15/2012 11:00:00 AM
091211943-0066	HM-BG HK-02	11/15/2012 11:00:00 AM
091211943-0067	HM-BG HK-03	11/15/2012 11:00:00 AM
091211943-0068	HM-BG HK-04	11/15/2012 11:00:00 AM
091211943-0069	HM-BG RS-01	11/15/2012 11:00:00 AM
091211943-0070	HM-BG RS-02	11/15/2012 11:00:00 AM
091211943-0071	HM-BG RS-03	11/15/2012 11:00:00 AM
091211943-0072	HM-BG RS-04	11/15/2012 11:00:00 AM
091211943-0073	HM-BG AA-01	11/15/2012 11:00:00 AM
091211943-0074	HM-BG AA-02	11/15/2012 11:00:00 AM
091211943-0075	HM-BG AA-03	11/15/2012 11:00:00 AM
091211943-0076	HM-FB	11/15/2012 11:00:00 AM

6. Equipment Performance Checks

Daily TEM Calibration Sheet

Month: November Year: 2012 Scope: 04-01 AM

Day (1-31)	Analyst Initials	Scope Align.	LN Dewar Filled	Al Peak Actual	Al Peak Accepted Limit	Cu Peak Actual	Cu Peak Accepted Limit	Pass/Fail* (circle)
1	FL	✓	✓	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
2	FL	✓		1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
3					1.47-1.49		8.03-8.05	Pass/Fail
4	FL	✓		1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
5	FL	✓	✓	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
6	FL	✓		1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
7	FL	✓	PH	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
8	FL	✓		1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
9	FL	✓	✓	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
10	FL	✓		1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
11					1.47-1.49		8.03-8.05	Pass/Fail
12	FL	✓	✓	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
13	FL	✓		1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
14	FL	✓	✓	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
15	FL	✓		1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
16	FL	✓	✓	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
17	FL				1.47-1.49		8.03-8.05	Pass/Fail
18	FL	✓	✓	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
19	FL	✓	PH	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
20	FL	✓		1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
21	FL	✓	✓	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
22					1.47-1.49		8.03-8.05	Pass/Fail
23			PH		1.47-1.49		8.03-8.05	Pass/Fail
24					1.47-1.49		8.03-8.05	Pass/Fail
25					1.47-1.49		8.03-8.05	Pass/Fail
26			PH		1.47-1.49		8.03-8.05	Pass/Fail
27					1.47-1.49		8.03-8.05	Pass/Fail
28			PH		1.47-1.49		8.03-8.05	Pass/Fail
29					1.47-1.49		8.03-8.05	Pass/Fail
30	FL	✓	PH	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
31					1.47-1.49		8.03-8.05	Pass/Fail

*** Any failing results need immediate corrective action**

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Daily TEM Calibration Sheet

Month: Nov Year: 2012 Scope: 04-03

Day (1-31)	Analyst Initials	Scope Align.	LN Dewar Filled	Al Peak Actual	Al Peak Accepted Limit	Cu Peak Actual	Cu Peak Accepted Limit	Pass/Fail* (circle)
1	PH	PH		1.48	1.47-1.49	8.05	8.03-8.05	Pass/Fail
2	PH	PH	PH	1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
3					1.47-1.49		8.03-8.05	Pass/Fail
4					1.47-1.49		8.03-8.05	Pass/Fail
5	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
6	PH	PH		1.48	1.47-1.49	8.05	8.03-8.05	Pass/Fail
7	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
8					1.47-1.49		8.03-8.05	Pass/Fail
9					1.47-1.49		8.03-8.05	Pass/Fail
10					1.47-1.49		8.03-8.05	Pass/Fail
11					1.47-1.49		8.03-8.05	Pass/Fail
12	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
13	PH	PH		1.47	1.47-1.49	8.04	8.03-8.05	Pass/Fail
14	PH	PH	FC	1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
15	PH	PH		1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
16	PH	PH	FC	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
17					1.47-1.49		8.03-8.05	Pass/Fail
18			FC		1.47-1.49		8.03-8.05	Pass/Fail
19	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
20	PH	PH		1.47	1.47-1.49	8.04	8.03-8.05	Pass/Fail
21	PH	PH	FC	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
22					1.47-1.49		8.03-8.05	Pass/Fail
23	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
24					1.47-1.49		8.03-8.05	Pass/Fail
25					1.47-1.49		8.03-8.05	Pass/Fail
26	PH	PH	PH	1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
27	PH	PH		1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
28	PH	PH	PH	1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
29	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
30	PH	PH	PH	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
31					1.47-1.49		8.03-8.05	Pass/Fail

*** Any failing results need immediate corrective action**

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Daily TEM Calibration Sheet

Month: November Year: 2012 Scope: 04-05

Day (1-31)	Analyst Initials	Scope Align.	LN Dewar Filled	Al Peak Actual	Al Peak Accepted Limit	Cu Peak Actual	Cu Peak Accepted Limit	Pass/Fail* (circle)
1	KT	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
2					1.47-1.49		8.03-8.05	Pass/Fail
3					1.47-1.49		8.03-8.05	Pass/Fail
4	RD	✓		1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
5	KT	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
6	KT	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
7	KT	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
8	[illegible]	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
9	KT	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
10					1.47-1.49		8.03-8.05	Pass/Fail
11	[illegible]	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
12	KT	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
13	LM	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
14	LM	✓	FC	1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
15	LM	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
16	KT	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
17	[illegible]	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
18					1.47-1.49		8.03-8.05	Pass/Fail
19	LM	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
20	LM	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
21	[illegible]	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
22					1.47-1.49		8.03-8.05	Pass/Fail
23	LM	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
24					1.47-1.49		8.03-8.05	Pass/Fail
25	[illegible]	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
26					1.47-1.49		8.03-8.05	Pass/Fail
27	LM	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
28	LM	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
29	LM	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
30					1.47-1.49		8.03-8.05	Pass/Fail
31					1.47-1.49		8.03-8.05	Pass/Fail

*** Any failing results need immediate corrective action**

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Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-01

Detector: PGT/ Revolution

Chrysotile Beam Dose Sensitivity

(Quarterly)

Date	Initials	Negative Numbers		At least 90% of patterns >15 seconds ?
		SAED	Morphology	
4/15/2010	FC	010170	010171	PASS
7/14/2010	FC	010356	010357	PASS
10/12/2010	FC	010735	010736	PASS
1/13/2011	FC	010024	010025	PASS
4/12/2011	FC	010383	010384	PASS
6/9/2011	FC	010774	010775	PASS
9/8/2011	FC	011096	011097	PASS
12/5/2011	FC	11318	11319	PASS
3/5/2012	FC	010199	010200	PASS
5/8/2012	FC	010419	010420	PASS
8/7/2012	FC	010817	010818	PASS
11/7/2012	FC	011370	011371	PASS

Comments:

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

Negative (Camera)					
Date	Initials	Negative Number	Camera Length	Camera Constant	Is 2 Standard Dev. < 5% Mean?
6/26/2012	FC	10734	83	340.03	PASS
7/10/2012	FC	10735	83	339.18	PASS
7/17/2012	FC	10757	83	327.91	PASS
7/24/2012	FC	10790	83	337.25	PASS
7/31/2012	FC	10812	83	337.80	PASS
8/7/2012	FC	10813	83	334.28	PASS
8/14/2012	FC	10856	83	335.35	PASS
8/21/2012	FC	10883	83	335.83	PASS
8/28/2012	FC	810905	83	339.44	PASS
9/4/2012	FC	10928	83	336.02	PASS
9/11/2012	FC	10980	83	339.64	PASS
9/18/2012	FC	11017	83	338.84	PASS
9/26/2012	FC	11059	83	336.98	PASS
10/2/2012	FC	11103	83	340.05	PASS
10/9/2012	FC	11187	83	337.75	PASS
10/16/2012	FC	11228	83	338.71	PASS
10/23/2012	FC	11282	83	337.94	PASS
11/7/2012	FC	11366	83	339.34	PASS
11/14/2012	FC	11428	83	340.45	PASS
11/20/2012	FC	11446	83	337.69	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-01

Detector: PGT/ Revolution

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

On Screen					
Date	Initials	Camera Length	Aperture #	Aperture Diameter	Is 2 Standard Dev. < 5% Mean?
6/19/2012	FC	22	2	1.06	PASS
6/26/2012	FC	22	2	1.06	PASS
7/10/2012	FC	22	2	1.06	PASS
7/24/2012	FC	22	2	1.04	PASS
7/31/2012	FC	22	2	1.04	PASS
8/7/2012	FC	22	2	1.04	PASS
8/14/2012	FC	22	2	1.06	PASS
8/21/2012	FC	22	2	1.04	PASS
8/28/2012	FC	22	2	1.04	PASS
9/4/2012	FC	22	2	1.04	PASS
9/11/2012	FC	22	2	1.04	PASS
9/18/2012	FC	22	2	1.04	PASS
9/26/2012	FC	22	2	1.06	PASS
10/2/2012	FC	22	2	1.04	PASS
10/9/2012	FC	22	2	1.04	PASS
10/16/2012	FC	22	2	1.06	PASS
10/23/2012	FC	22	2	1.04	PASS
11/7/2012	FC	22	2	1.04	PASS
11/14/2012	FC	22	2	1.04	PASS
11/20/2012	FC	22	2	1.04	PASS

The above aperture diameter represents the on screen diameter in reciprocal space. Multiply this number times the number of layer lines seen to get layer line spacing.

Comments:

Plasma Asher Calibration

(Quarterly)

Time To Ash 5% of Collapsed MCE Filter			
Date	Initials	Min	Sec
9/13/2010	WP	4	27
10/27/2010	DS	4	20
2/8/2011	WP	5	16
5/18/2011	WP	3	59
11/3/2011	WP	4	09
2/7/2012	WP	3	01
5/22/2012	WP	2	35
8/30/2012	WP	3	54
10/25/2012	WP	11	44
10/25/2012	WP	5	49

Comments: This asher was re-instated in November 3, 2011. During it's inactivity, the EMSL asher on Scope 04-02 log was in use.

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-01

Detector: PGT/ Revolution

Magnification Calibrations
(Monthly)

20,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
4/12/2011	FC	20344	20574	PASS
5/12/2011	FC	20344	20520	PASS
6/9/2011	FC	20344	20304	PASS
7/11/2011	FC	20344	20412	PASS
8/11/2011	FC	20344	20358	PASS
9/8/2011	FC	20344	20358	PASS
10/8/2011	FC	20344	20142	PASS
11/8/2011	FC	20344	20412	PASS
12/5/2011	FC	20344	20304	PASS
1/5/2012	PH	20344	21222	PASS
2/5/2012	FC	20344	20574	PASS
3/5/2012	FC	20344	20412	PASS
4/10/2012	FC	20344	20358	PASS
5/8/2012	FC	20344	20412	PASS
6/7/2012	FC	20344	20358	PASS
7/6/2012	FC	20344	20034	PASS
8/7/2012	FC	20344	19980	PASS
9/7/2012	FC	20344	19818	PASS
10/5/2012	FC	20344	19980	PASS
11/7/2012	FC	20344	19872	PASS

Comments:

20,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
4/12/2011	FC	15632	15594	PASS
5/12/2011	FC	15632	15594	PASS
6/9/2011	FC	15632	15594	PASS
7/11/2011	FC	15632	15594	PASS
8/11/2011	FC	15632	15223	PASS
9/8/2011	FC	15632	15594	PASS
10/8/2011	FC	15632	15594	PASS
11/8/2011	FC	15632	15594	PASS
12/5/2011	FC	15632	15594	PASS
1/5/2012	PH	15632	15594	PASS
2/5/2012	FC	15632	15594	PASS
3/5/2012	FC	15632	15984	PASS
4/10/2012	FC	15632	15826	PASS
5/8/2012	FC	15632	15826	PASS
6/7/2012	FC	15632	15594	PASS
7/6/2012	FC	15632	15594	PASS
8/7/2012	FC	15632	15594	PASS
9/7/2012	FC	15632	15826	PASS
10/5/2012	FC	15632	15594	PASS
11/7/2012	FC	15632	15594	PASS

Comments:

10,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
4/12/2011	FC	10753	10854	PASS
5/12/2011	FC	10753	10908	PASS
6/9/2011	FC	10753	10692	PASS
7/11/2011	FC	10753	10854	PASS
8/11/2011	FC	10753	10800	PASS
9/8/2011	FC	10753	10746	PASS
10/8/2011	FC	10753	10746	PASS
11/8/2011	FC	10753	10908	PASS
12/5/2011	FC	10753	10908	PASS
1/5/2012	PH	10753	10800	PASS
2/5/2012	FC	10753	11016	PASS
3/5/2012	FC	10753	10854	PASS
4/10/2012	FC	10753	10800	PASS
5/8/2012	FC	10753	10638	PASS
6/7/2012	FC	10753	10692	PASS
7/6/2012	FC	10753	10638	PASS
8/7/2012	FC	10753	10314	PASS
9/7/2012	FC	10753	10557	PASS
10/5/2012	FC	10753	10584	PASS
11/7/2012	FC	10753	10422	PASS

Comments:

10,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
4/12/2011	FC	8326	8303	PASS
5/12/2011	FC	8326	8413	PASS
6/9/2011	FC	8326	8197	PASS
7/11/2011	FC	8326	8413	PASS
8/11/2011	FC	8326	8303	PASS
9/8/2011	FC	8326	8303	PASS
10/8/2011	FC	8326	8303	PASS
11/8/2011	FC	8326	8303	PASS
12/5/2011	FC	8326	8413	PASS
1/5/2012	PH	8326	8640	PASS
2/5/2012	FC	8326	8303	PASS
3/5/2012	FC	8326	8413	PASS
4/10/2012	FC	8326	8369	PASS
5/8/2012	FC	8326	8413	PASS
6/7/2012	FC	8326	8413	PASS
7/6/2012	FC	8326	8197	PASS
8/7/2012	FC	8326	8303	PASS
9/7/2012	FC	8326	8093	PASS
10/5/2012	FC	8326	8093	PASS
11/7/2012	FC	8326	8197	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-01

Detector: PGT/ Revolution

Calibration of On Screen 0.5 and 5µm Measuring Aids at EPA AHERA Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
4/12/2011	FC	0.48	4.75
5/12/2011	FC	0.48	4.75
6/9/2011	FC	0.48	4.75
7/11/2011	FC	0.48	4.75
8/11/2011	FC	0.49	4.86
9/8/2011	FC	0.48	4.75
10/8/2011	FC	0.48	4.75
11/8/2011	FC	0.48	4.75
12/5/2011	FC	0.48	4.75
1/5/2012	PH	0.48	4.75
2/5/2012	FC	0.48	4.75
3/5/2012	FC	0.47	4.63
4/10/2012	FC	0.47	4.68
5/8/2012	FC	0.47	4.68
6/7/2012	FC	0.48	4.75
7/6/2012	FC	0.48	4.75
8/7/2012	FC	0.48	4.75
9/7/2012	FC	0.47	4.68
10/5/2012	FC	0.48	4.75
11/7/2012	FC	0.48	4.75

Comments:

Calibration of On Screen 1.0 and 10µm Measuring Aids at EPA 100.2 Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
4/12/2011	FC	0.90	8.91
5/12/2011	FC	0.89	8.80
6/9/2011	FC	0.91	9.03
7/11/2011	FC	0.89	8.80
8/11/2011	FC	0.90	8.91
9/8/2011	FC	0.90	8.91
10/8/2011	FC	0.90	8.91
11/8/2011	FC	0.90	8.91
12/5/2011	FC	0.89	8.80
1/5/2012	PH	0.87	8.56
2/5/2012	FC	0.90	8.91
3/5/2012	FC	0.89	8.80
4/10/2012	FC	0.90	8.84
5/8/2012	FC	0.89	8.80
6/7/2012	FC	0.89	8.80
7/6/2012	FC	0.91	9.03
8/7/2012	FC	0.90	8.91
9/7/2012	FC	0.93	9.14
10/5/2012	FC	0.93	9.14
11/7/2012	FC	0.91	9.03

Comments:

Spot Size Measurements

(Quarterly)

Date	Initials	Actual Spot	Target Spot Size	FAIL ≤250nm =	Is 2 SD <25% of
8/11/2008	FC	244.34	≤ 250 nm	PASS	PASS
10/21/2008	FC	216.27	≤ 250 nm	PASS	PASS
11/25/2008	FC	217.86	≤ 250 nm	PASS	PASS
1/19/2009	FC	219.30	≤ 250 nm	PASS	PASS
4/19/2009	FC	185.77	≤ 250 nm	PASS	PASS
7/19/2009	FC	187.33	≤ 250 nm	PASS	PASS
10/17/2009	FC	184.60	≤ 250 nm	PASS	PASS
1/16/2010	FC	192.90	< 250 nm	PASS	PASS
4/14/2010	FC	244.71	≤ 250 nm	PASS	PASS
7/15/2010	FC	246.26	≤ 250 nm	PASS	PASS
10/12/2010	FC	231.48	≤ 250 nm	PASS	PASS
1/13/2011	FC	238.10	≤ 250 nm	PASS	PASS
4/12/2011	FC	234.38	≤ 250 nm	PASS	PASS
6/9/2011	FC	246.26	≤ 250 nm	PASS	PASS
9/8/2011	FC	232.02	≤ 250 nm	PASS	PASS
12/5/2011	FC	233.94	≤ 250 nm	PASS	PASS
3/5/2012	FC	240.69	≤ 250 nm	PASS	PASS
5/8/2012	FC	235.22	≤ 250 nm	PASS	PASS
8/7/2012	FC	245.25	≤ 250 nm	PASS	PASS
11/7/2012	FC	150.97	≤ 250 nm	PASS	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-01

Detector: PGT/ Revolution

K Factors

(Semi-Annually)

Test Dates	Initials	Mean K Factor	Pass Criteria	Actual	PASS FAIL	Acceptance Criteria	PASS/FAIL
8/7/2012	FC	Mg:Si	1.0 - 2.0	1.13	PASS	2SD < 10% Mean	PASS
8/8/2012	FC	Ca:Si	1.0 - 1.75	1.47	PASS	2SD < 10% Mean	PASS
----		Fe:Si	1.0 - 2.0	1.90	PASS	2SD < 10% Mean	PASS
----		Mg:Fe	1.5 or less	0.60	PASS	N / A	N / A
8/8/2012	FC	Na:Si	1.0 - 4.0	1.47	PASS	2SD < 20% Mean	PASS
6/12/2012	FC	Al:Si	1.0 - 1.75	1.03	PASS	2SD < 10% Mean	PASS

Comments:

Detector Resolution

(Semi-Annually / Quarterly when necessary to meet TNI Standard)

Date	@Mn Kα Peak Initials	Resolution	<175?	Resolution + 2(s) <180?
3/5/2012	FC	128.0	Pass	Pass
8/7/2012	FC	125.0	Pass	Pass
8/8/2012	FC	132.0	Pass	Pass
8/10/2012	FC	130.0	Pass	Pass
8/12/2012	FC	119.0	Pass	Pass
8/13/2012	FC	130.0	Pass	Pass
8/14/2012	FC	118.0	Pass	Pass
8/15/2012	FC	131.0	Pass	Pass
8/16/2012	FC	131.0	Pass	Pass
8/17/2012	FC	146.0	Pass	Pass

Comments: Drift noted on standard deviation on Dec 2011. Will monitor this trend going forward. July 2012, detector is scheduled for de-icing due to drift.

Significant Na and Resolvable Mg-Si Peaks

(Quarterly)

Date	Initials	Significant Na		Date	Initials	Resolvable Mg	Si
9/13/2010	FC	Pass		9/13/10	FC	Yes	Yes
12/13/2010	FC	Pass		12/13/10	FC	Yes	Yes
3/15/2011	FC	Pass		3/15/11	FC	Yes	Yes
6/9/2011	FC	Pass		6/9/11	FC	Yes	Yes
9/8/2011	FC	Pass		9/8/11	FC	Yes	Yes
12/5/2011	FC	Pass		12/5/11	FC	Yes	Yes
3/5/2012	FC	Pass		3/5/12	FC	Yes	Yes
5/8/2012	FC	Pass		5/8/12	FC	Yes	Yes
8/7/2012	FC	Pass		8/7/12	FC	Yes	Yes
11/7/2012	FC	Pass		11/7/12	FC	Yes	Yes

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-03
Detector: PGT Avalon

Chrysotile Beam Dose Sensitivity

(Quarterly)

Date	Initials	Negative Numbers		At least 90% of patterns >15 seconds ?
		SAED	Morphology	
2/8/2010	DY	03_372	03_373	PASS
5/18/2010	DY	03373	03374	PASS
8/16/2010	DY	03030	03031	PASS
11/5/2010	CG	11-5-10CG6	11-5-10CG5	PASS
2/18/2011	CG	03125	03126	PASS
5/20/2011	CG	03155	03154	PASS
8/18/2011	CG	03227	03228	PASS
11/4/2011	CG	03316	03317	PASS
2/7/2012	RD	MSL 0403 12	EMSL 0403 129	PASS
4/30/2012	PH	03128	03129	PASS
7/23/2012	PH	03303	03304	PASS
10/15/2012	PH	03466	03467	PASS

Comments:

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

Negative (Camera)					
Date	Initials	Negative Number	Camera Length	Camera Constant	Is 2 Standard Dev. < 5% Mean?
7/30/2012	PH	03311	100	533.18	PASS
8/6/2012	PH	03316	100	533.04	PASS
8/13/2012	PH	03330	100	517.48	PASS
8/20/2012	PH	03337	100	520.02	PASS
8/27/2012	PH	03350	100	510.81	PASS
8/31/2012	PH	03360	100	508.97	PASS
9/5/2012	PH	03365	100	508.05	PASS
9/10/2012	PH	03367	100	523.88	PASS
9/17/2012	PH	03382	100	511.59	PASS
9/24/2012	PH	03400	100	540.57	PASS
10/1/2012	PH	03425	100	518.78	PASS
10/8/2012	PH	03451	100	500.68	PASS
10/15/2012	PH	03465	100	526.78	PASS
10/22/2012	PH	03482	100	512.41	PASS
10/31/2012	PH	03505	100	513.87	PASS
11/5/2012	PH	03523	100	510.06	PASS
11/12/2012	PH	03533	100	517.24	PASS
11/19/2012	PH	03553	100	519.08	PASS
11/26/2012	PH	03562	100	522.30	PASS
12/3/2012	PH	03563	100	520.26	PASS

Comments: Scope down for repair 2/23/12 through 2/29/12. Weekly calibrations not done during this time.

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-03
Detector: PGT Avalon

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

On Screen					
Date	Initials	Camera Length	Aperture #	Aperture Diameter	Is 2 Standard Dev. < 5% Mean?
7/30/2012	PH	24	1	1.20	PASS
8/6/2012	PH	24	1	1.20	PASS
8/13/2012	PH	24	1	1.20	PASS
8/20/2012	PH	24	1	1.18	PASS
8/27/2012	PH	24	1	1.18	PASS
8/31/2012	PH	24	1	1.18	PASS
9/5/2012	PH	24	1	1.20	PASS
9/10/2012	PH	24	1	1.20	PASS
9/17/2012	PH	24	1	1.20	PASS
9/24/2012	PH	24	1	1.20	PASS
10/1/2012	PH	24	1	1.20	PASS
10/8/2012	PH	24	1	1.20	PASS
10/15/2012	PH	24	1	1.20	PASS
10/22/2012	PH	24	1	1.20	PASS
10/31/2012	PH	24	1	1.20	PASS
11/5/2012	PH	24	1	1.20	PASS
11/12/2012	PH	24	1	1.18	PASS
11/19/2012	PH	24	1	1.20	PASS
11/26/2012	PH	24	1	1.20	PASS
12/3/2012	PH	24	1	1.20	PASS

The above aperture diameter represents the on screen diameter in reciprocal space. Multiply this number times the number of layer lines seen to get layer line spacing.

Comments: Scope down for repair 2/23/12 through 2/29/12, Weekly calibrations not done during that time.

Plasma Asher Calibration

(Quarterly)

Time To Ash 5% of Collapsed MCE Filter			
Date	Initials	Min	Sec
10/28/2009	SNS	3	18
2/2/2010	SNS	6	49
5/12/2010	DY	7	28
8/20/2010	DS	9	32
9/13/2010	WP	4	15

Comments: This asher is no longer in use as of Dec 2010. The asher currently in use for TEM prep is on the Scope 0401 calibration report.

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-03

Detector: PGT Avalon

Magnification Calibrations
(Monthly)

20,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
6/13/2011	CG	20740	20304	PASS
7/12/2011	CG	20740	20790	PASS
8/11/2011	CG	20740	21276	PASS
9/15/2011	CG	20740	20385	PASS
10/12/2011	CG	20740	20925	PASS
11/4/2011	CG	20740	21060	PASS
12/4/2011	CG	20740	20925	PASS
1/4/2012	CG	20740	21060	PASS
2/7/2012	RD	20740	19764	PASS
3/2/2012	PH	20740	20844	PASS
3/30/2012	PH	20740	20628	PASS
4/27/2012	PH	20740	20412	PASS
5/25/2012	PH	20740	21060	PASS
6/18/2012	PH	20740	20952	PASS
7/13/2012	PH	20740	20952	PASS
8/6/2012	PH	20740	20628	PASS
8/27/2012	PH	20740	20628	PASS
9/25/2012	PH	20740	20952	PASS
10/22/2012	PH	20740	20520	PASS
11/19/2012	PH	20740	20520	PASS

Comments:

20,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
6/13/2011	CG	14357	14521	PASS
7/12/2011	CG	14357	14400	PASS
8/11/2011	CG	14357	14521	PASS
9/15/2011	CG	14357	14521	PASS
10/11/2011	CG	14357	14281	PASS
11/4/2011	CG	14357	14400	PASS
12/4/2011	CG	14357	14281	PASS
1/4/2012	CG	14357	14281	PASS
2/7/2012	RD	14357	14281	PASS
3/2/2012	PH	14357	14400	PASS
3/30/2012	PH	14357	14164	PASS
4/27/2012	PH	14357	14281	PASS
5/25/2012	PH	14357	14281	PASS
6/18/2012	PH	14357	14521	PASS
7/13/2012	PH	14357	14400	PASS
8/6/2012	PH	14357	14281	PASS
8/27/2012	PH	14357	14281	PASS
9/25/2012	PH	14357	14400	PASS
10/22/2012	PH	14357	14281	PASS
11/19/2012	PH	14357	14164	PASS

Comments:

10,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
6/13/2011	CG	10461	10303	PASS
7/12/2011	CG	10461	10368	PASS
8/11/2011	CG	10461	10627	PASS
9/15/2011	CG	10461	10152	PASS
10/12/2011	CG	10461	10584	PASS
11/4/2011	CG	10461	10541	PASS
12/4/2011	CG	10461	10476	PASS
1/4/2012	CG	10461	10584	PASS
2/7/2012	RD	10461	9936	PASS
3/2/2012	PH	10461	10584	PASS
3/30/2012	PH	10461	10476	PASS
4/27/2012	PH	10461	10476	PASS
5/25/2012	PH	10461	10368	PASS
6/18/2012	PH	10461	10476	PASS
7/13/2012	PH	10461	10584	PASS
8/6/2012	PH	10461	10476	PASS
8/27/2012	PH	10461	10584	PASS
9/25/2012	ph	10461	10584	PASS
10/22/2012	PH	10461	10584	PASS
11/19/2012	PH	10461	10692	PASS

Comments:

10,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
6/13/2011	CG	7242	7353	PASS
7/12/2011	CG	7242	7291	PASS
8/11/2011	CG	7242	7322	PASS
9/15/2011	CG	7242	7200	PASS
10/11/2011	CG	7242	7140	PASS
11/4/2011	CG	7242	7140	PASS
12/4/2011	CG	7242	7170	PASS
1/4/2012	CG	7242	7170	PASS
2/7/2012	RD	7242	7170	PASS
3/2/2012	PH	7242	7261	PASS
3/30/2012	PH	7242	7111	PASS
4/27/2012	PH	7242	7200	PASS
5/25/2012	PH	7242	7230	PASS
6/18/2012	PH	7242	7291	PASS
7/13/2012	PH	7242	7230	PASS
8/6/2012	PH	7242	7200	PASS
8/27/2012	PH	7242	7353	PASS
9/25/2012	PH	7242	7416	PASS
10/22/2012	PH	7242	7353	PASS
11/19/2012	PH	7242	7322	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-03
Detector: PGT Avalon

Calibration of On Screen 0.5 and 5µm Measuring Aids at EPA AHERA Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
6/13/2011	CG	0.55	5.51
7/12/2011	CG	0.56	5.56
8/11/2011	CG	0.55	5.51
9/15/2011	CG	0.55	5.51
10/11/2011	CG	0.56	5.60
11/4/2011	CG	0.56	5.56
12/4/2011	CG	0.56	5.60
1/4/2012	CG	0.56	5.60
2/7/2012	RD	0.56	5.60
3/2/2012	PH	0.56	5.56
3/30/2012	PH	0.56	5.65
4/27/2012	PH	0.56	5.60
5/25/2012	PH	0.56	5.60
6/18/2012	PH	0.55	5.51
7/13/2012	PH	0.56	5.56
8/6/2012	PH	0.56	5.60
8/27/2012	PH	0.56	5.60
9/25/2012	PH	0.56	5.56
10/22/2012	PH	0.56	5.60
11/19/2012	PH	0.56	5.65

Comments:

Calibration of On Screen 1.0 and 10µm Measuring Aids at EPA 100.2 Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
6/13/2011	CG	1.09	10.88
7/12/2011	CG	1.10	10.97
8/11/2011	CG	1.09	10.93
9/15/2011	CG	1.11	11.11
10/11/2011	CG	1.12	11.20
11/4/2011	CG	1.12	11.20
12/4/2011	CG	1.12	11.16
1/4/2012	CG	1.12	11.16
2/7/2012	RD	1.12	11.16
3/2/2012	PH	1.10	11.02
3/30/2012	PH	1.13	11.25
4/27/2012	PH	1.11	11.11
5/25/2012	PH	1.11	11.06
6/18/2012	PH	1.10	10.97
7/13/2012	PH	1.11	11.06
8/6/2012	PH	1.11	11.11
8/27/2012	PH	1.09	10.88
9/25/2012	PH	1.08	10.79
10/22/2012	PH	1.09	10.88
11/19/2012	PH	1.09	10.93

Comments:

Spot Size Measurements

(Quarterly)

Date	Initials	Actual Spot	Target Spot Size	FAIL ≤250nm =	Is 2 SD <25% of
6/13/2011	CG	231.48	≤ 250 nm	PASS	PASS
7/12/2011	CG	216.45	≤ 250 nm	PASS	PASS
8/11/2011	CG	197.41	≤ 250 nm	PASS	PASS
9/15/2011	CG	245.28	≤ 250 nm	PASS	PASS
10/12/2011	CG	215.05	≤ 250 nm	PASS	PASS
11/4/2011	CG	223.17	≤ 250 nm	PASS	PASS
12/4/2011	CG	219.83	≤ 250 nm	PASS	PASS
1/4/2012	CG	213.68	< 250 nm	PASS	PASS
2/7/2012	RD	207.45	≤ 250 nm	PASS	PASS
3/2/2012	PH	191.90	≤ 250 nm	PASS	PASS
3/30/2012	PH	184.22	≤ 250 nm	PASS	PASS
4/27/2012	PH	195.96	≤ 250 nm	PASS	PASS
5/25/2012	PH	189.93	≤ 250 nm	PASS	PASS
6/18/2012	PH	167.05	≤ 250 nm	PASS	PASS
7/13/2012	PH	181.37	≤ 250 nm	PASS	PASS
8/6/2012	PH	169.67	≤ 250 nm	PASS	PASS
8/27/2012	PH	218.15	≤ 250 nm	PASS	PASS
9/25/2012	PH	190.91	≤ 250 nm	PASS	PASS
10/22/2012	PH	194.93	≤ 250 nm	PASS	PASS
11/19/2012	PH	194.93	≤ 250 nm	PASS	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-03

Detector: PGT Avalon

K Factors

(Semi-Annually)

Test Dates	Initials	Mean K Factor	Pass Criteria	Actual	PASS FAIL	Acceptance Criteria	PASS/FAIL
11/12/2012	PH	Mg:Si	1.0 - 2.0	1.78	PASS	2SD < 10% Mean	PASS
5/21/2012	PH	Ca:Si	1.0 - 1.75	1.20	PASS	2SD < 10% Mean	PASS
----		Fe:Si	1.0 - 2.0	1.61	PASS	2SD < 10% Mean	PASS
----		Mg:Fe	1.5 or less	1.11	PASS	N / A	N / A
11/12/2012	PH	Na:Si	1.0 - 4.0	2.88	PASS	2SD < 20% Mean	PASS
5/21/2012	PH	Al:Si	1.0 - 1.75	1.17	PASS	2SD < 10% Mean	PASS

Comments:

Detector Resolution

(Semi-Annually / Quarterly when necessary to meet TNI Standard)

Date	@Mn Kα Peak Initials	Resolution	<175?	Resolution + 2(s) <180?
4/28/2010	DY	131.0	Pass	Pass
11/4/2010	CG	120.0	Pass	Pass
5/20/2011	CG	135.0	Pass	Pass
8/18/2011	CG	125.0	Pass	Pass
11/4/2011	CG	135.0	Pass	Pass
2/7/2012	GPA	134.8	Pass	Pass
2/7/2012	RD	117.3	Pass	Pass
4/30/2012	PH	127.7	Pass	Pass
7/23/2012	PH	124.4	Pass	Pass
10/15/2012	PH	127.7	Pass	Pass

Comments:

Significant Na and Resolvable Mg-Si Peaks

(Quarterly)

Date	Initials	Significant Na		Date	Initials	Resolvable Mg	Resolvable Si
7/28/2010	DY	Pass		7/28/10	DY	Yes	Yes
11/5/2010	CG	Pass		11/4/10	CG	Yes	Yes
2/18/2011	CG	Pass		2/18/11	CG	Yes	Yes
5/20/2011	CG	Pass		5/20/11	CG	Yes	Yes
8/18/2011	CG	Pass		8/18/11	CG	Yes	Yes
11/4/2011	CG	Pass		11/4/11	CG	Yes	Yes
2/7/2012	RD	Pass		2/7/12	RD	Yes	Yes
4/30/2012	PH	Pass		4/30/12	PH	Yes	Yes
7/23/2012	PH	Pass		7/23/12	PH	Yes	Yes
10/15/2012	PH	Pass		10/15/12	PH	Yes	Yes

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-05

Detector: PGT/ Revolution

Chrysotile Beam Dose Sensitivity

(Quarterly)

Date	Initials	Negative Numbers		At least 90% of patterns >15 seconds ?
		SAED	Morphology	
8/7/2012	KT	Cal_130	Cal_129	PASS
8/8/2012	KT	95356	95357	PASS
8/17/2012	KT	Cal_003	Cal_004	PASS
8/17/2012	KT	Cal_007	Cal_008	PASS
8/21/2012	KT	Cal_011	Cal_010	PASS
8/22/2012	KT	Cal_013	Cal_014	PASS
8/23/2012	KT	Cal_018	Cal_019	PASS
8/27/2012	KT	Cal_027	Cal_028	PASS
8/28/2012	KT	Cal_033	Cal_034	PASS
8/29/2012	KT	Cal_039	Cal_040	PASS
8/31/2012	KT	Cal_045	Cal_046	PASS
9/4/2012	KT	Cal_051	Cal_052	PASS

Comments:

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

Negative (Camera)					
Date	Initials	Negative Number	Camera Length	Camera Constant	Is 2 Standard Dev. < 5% Mean?
9/6/2012	KT	Cal_061	22	1.79	PASS
9/7/2012	KT	Cal_065	22	1.85	PASS
9/10/2012	KT	Cal_069	22	1.85	PASS
9/11/2012	KT	Cal_073	22	1.83	PASS
9/13/2012	KT	Cal_079	22	1.93	PASS
9/14/2012	KT	Cal_083	22	1.90	PASS
9/17/2012	KT	Cal_087	22	1.90	PASS
9/18/2012	KT	Cal_092	22	1.90	PASS
9/19/2012	KT	Cal_093	22	1.91	PASS
9/20/2012	KT	Cal_097	22	1.88	PASS
9/27/2012	KT	Cal_112	22	1.88	PASS
10/4/2012	KT	Cal_113	22	1.88	PASS
10/11/2012	KT	Cal_114	22	1.90	PASS
10/17/2012	KT	Cal_115	22	1.92	PASS
10/24/2012	KT	Cal_116	22	1.96	PASS
10/31/2012	KT	Cal_120	22	1.83	PASS
11/7/2012	KT	Cal_121	22	1.92	PASS
11/16/2012	KT	Cal_122	22	1.91	PASS
11/23/2012	LM	Cal_129	22	1.83	PASS
12/3/2012	LM	Cal_131	22	1.89	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-05

Detector: PGT/ Revolution

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

On Screen					
Date	Initials	Camera Length	Aperture #	Aperture Diameter	Is 2 Standard Dev. < 5% Mean?
9/6/2012	KT	22	2	0.82	PASS
9/7/2012	KT	22	2	0.82	PASS
9/10/2012	KT	22	2	0.83	PASS
9/11/2012	KT	22	2	0.83	PASS
9/13/2012	KT	22	2	0.80	PASS
9/14/2012	KT	22	2	0.82	PASS
9/17/2012	KT	22	2	0.82	PASS
9/18/2012	KT	22	2	0.83	PASS
9/19/2012	KT	22	2	0.82	PASS
9/20/2012	KT	22	2	0.80	PASS
9/27/2012	KT	22	2	0.80	PASS
10/4/2012	KT	22	2	0.80	PASS
10/11/2012	KT	22	2	0.80	PASS
10/17/2012	KT	22	2	0.82	PASS
10/24/2012	KT	22	2	0.82	PASS
10/31/2012	KT	22	2	0.80	PASS
11/7/2012	KT	22	2	0.82	PASS
11/16/2012	KT	22	2	0.82	PASS
11/23/2012	LM	22	2	0.82	PASS
12/3/2012	LM	22	2	0.82	PASS

The above aperture diameter represents the on screen diameter in reciprocal space. Multiply this number times the number of layer lines seen to get layer line spacing.

Comments:

Plasma Asher Calibration

(Quarterly)

Time To Ash 5% of Collapsed MCE Filter			
Date	Initials	Min	Sec
9/12/2012	WP	4	11
10/25/2012	WP	6	02

Comments: March Plasmod Asher in Bulk Prep for Special Projects only

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-05

Detector: PGT/ Revolution

Magnification Calibrations
(Monthly)

20,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
8/27/2012	KT	210560	213624	PASS
8/28/2012	KT	210560	210060	PASS
8/29/2012	KT	210560	209790	PASS
8/31/2012	KT	210560	210870	PASS
9/4/2012	KT	210560	210060	PASS
9/5/2012	KT	210560	209520	PASS
9/6/2012	KT	210560	211140	PASS
9/7/2012	KT	210560	212220	PASS
9/10/2012	KT	210560	211680	PASS
9/11/2012	KT	210560	210330	PASS
9/13/2012	KT	210560	210060	PASS
9/14/2012	KT	210560	212220	PASS
9/17/2012	KT	210560	208170	PASS
9/19/2012	KT	210560	207630	PASS
9/20/2012	KT	210560	210060	PASS
9/21/2012	KT	210560	207090	PASS
9/24/2012	KT	210560	212760	PASS
9/26/2012	KT	210560	212220	PASS
10/26/2012	KT	210560	211140	PASS
11/20/2012	LM	210560	215460	PASS

Comments:

20,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
8/24/2012	KT	15893	15826	PASS
8/27/2012	KT	15893	15984	PASS
8/28/2012	KT	15893	15984	PASS
8/29/2012	KT	15893	15826	PASS
8/31/2012	KT	15893	15826	PASS
9/4/2012	KT	15893	15826	PASS
9/5/2012	KT	15893	15826	PASS
9/6/2012	KT	15893	15826	PASS
9/7/2012	KT	15893	15984	PASS
9/10/2012	KT	15893	15984	PASS
9/11/2012	KT	15893	15984	PASS
9/13/2012	KT	15893	15984	PASS
9/14/2012	KT	15893	15826	PASS
9/17/2012	KT	15893	15826	PASS
9/19/2012	KT	15893	15826	PASS
9/20/2012	KT	15893	15671	PASS
9/21/2012	KT	15893	15826	PASS
9/26/2012	KT	15893	16145	PASS
10/26/2012	KT	15893	15984	PASS
11/20/2012	LM	15893	15984	PASS

Comments:

10,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
8/27/2012	KT	123338	123120	PASS
8/28/2012	KT	123338	122400	PASS
8/29/2012	KT	123338	123660	PASS
8/31/2012	KT	123338	123300	PASS
9/4/2012	KT	123338	124200	PASS
9/5/2012	KT	123338	123480	PASS
9/6/2012	KT	123338	123480	PASS
9/7/2012	KT	123338	123120	PASS
9/10/2012	KT	123338	123840	PASS
9/11/2012	KT	123338	123660	PASS
9/13/2012	KT	123338	123660	PASS
9/14/2012	KT	123338	122760	PASS
9/17/2012	KT	123338	120240	PASS
9/19/2012	KT	123338	123840	PASS
9/20/2012	KT	123338	124380	PASS
9/21/2012	KT	123338	122940	PASS
9/24/2012	KT	123338	123300	PASS
9/26/2012	KT	123338	124200	PASS
10/26/2012	KT	123338	123840	PASS
11/20/2012	LM	123338	126720	PASS

Comments:

10,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
8/23/2012	KT	8862	8880	PASS
8/27/2012	KT	8862	8880	PASS
8/28/2012	KT	8862	8831	PASS
8/29/2012	KT	8862	8831	PASS
8/31/2012	KT	8862	8831	PASS
9/4/2012	KT	8862	8831	PASS
9/5/2012	KT	8862	8880	PASS
9/6/2012	KT	8862	8880	PASS
9/7/2012	KT	8862	8880	PASS
9/10/2012	KT	8862	8880	PASS
9/13/2012	KT	8862	8831	PASS
9/14/2012	KT	8862	8880	PASS
9/17/2012	KT	8862	8880	PASS
9/19/2012	KT	8862	8880	PASS
9/20/2012	KT	8862	8782	PASS
9/21/2012	KT	8862	8831	PASS
9/24/2012	KT	8862	8880	PASS
9/26/2012	KT	8862	8930	PASS
10/26/2012	KT	8862	8880	PASS
11/20/2012	LM	8862	8831	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-05

Detector: PGT/ Revolution

Calibration of On Screen 0.5 and 5µm Measuring Aids at EPA AHERA Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
8/24/2012	KT	0.47	4.68
8/27/2012	KT	0.47	4.63
8/28/2012	KT	0.47	4.63
8/29/2012	KT	0.47	4.68
8/31/2012	KT	0.47	4.68
9/4/2012	KT	0.47	4.68
9/5/2012	KT	0.47	4.68
9/6/2012	KT	0.47	4.68
9/7/2012	KT	0.47	4.63
9/10/2012	KT	0.47	4.63
9/11/2012	KT	0.47	4.63
9/13/2012	KT	0.47	4.63
9/14/2012	KT	0.47	4.68
9/17/2012	KT	0.47	4.68
9/19/2012	KT	0.47	4.68
9/20/2012	KT	0.48	4.72
9/21/2012	KT	0.47	4.68
9/26/2012	KT	0.46	4.58
10/26/2012	KT	0.47	4.63
11/20/2012	LM	0.47	4.63

Comments:

Calibration of On Screen 1.0 and 10µm Measuring Aids at EPA 100.2 Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
8/23/2012	KT	0.84	8.33
8/27/2012	KT	0.84	8.33
8/28/2012	KT	0.85	8.38
8/29/2012	KT	0.85	8.38
8/31/2012	KT	0.85	8.38
9/4/2012	KT	0.85	8.38
9/5/2012	KT	0.84	8.33
9/6/2012	KT	0.84	8.33
9/7/2012	KT	0.84	8.33
9/10/2012	KT	0.84	8.33
9/13/2012	KT	0.85	8.38
9/14/2012	KT	0.84	8.33
9/17/2012	KT	0.84	8.33
9/19/2012	KT	0.84	8.33
9/20/2012	KT	0.85	8.43
9/21/2012	KT	0.85	8.38
9/24/2012	KT	0.84	8.33
9/26/2012	KT	0.84	8.29
10/26/2012	KT	0.84	8.33
11/20/2012	LM	0.85	8.38

Comments:

Spot Size Measurements

(Quarterly)

Date	Initials	Actual Spot	Target Spot Size	FAIL ≤250nm =	Is 2 SD <25% of
8/27/2012	KT	236.40	≤ 250 nm	PASS	PASS
8/28/2012	KT	228.51	≤ 250 nm	PASS	PASS
8/29/2012	KT	193.05	≤ 250 nm	PASS	PASS
8/31/2012	KT	246.60	≤ 250 nm	PASS	PASS
9/4/2012	KT	221.37	≤ 250 nm	PASS	PASS
9/5/2012	KT	224.32	≤ 250 nm	PASS	PASS
9/6/2012	KT	210.76	≤ 250 nm	PASS	PASS
9/7/2012	KT	226.18	< 250 nm	PASS	PASS
9/10/2012	KT	212.59	≤ 250 nm	PASS	PASS
9/11/2012	KT	175.91	≤ 250 nm	PASS	PASS
9/13/2012	KT	190.42	≤ 250 nm	PASS	PASS
9/14/2012	KT	202.62	≤ 250 nm	PASS	PASS
9/17/2012	KT	218.57	≤ 250 nm	PASS	PASS
9/19/2012	KT	219.14	≤ 250 nm	PASS	PASS
9/20/2012	KT	199.94	≤ 250 nm	PASS	PASS
9/21/2012	KT	224.54	≤ 250 nm	PASS	PASS
9/24/2012	KT	239.71	≤ 250 nm	PASS	PASS
9/26/2012	KT	240.32	≤ 250 nm	PASS	PASS
10/26/2012	KT	198.92	≤ 250 nm	PASS	PASS
11/20/2012	LM	194.93	≤ 250 nm	PASS	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Cinnaminson

Scope: 04-05

Detector: PGT/ Revolution

K Factors

(Semi-Annually)

Test Dates	Initials	Mean K Factor	Pass Criteria	Actual	PASS FAIL	Acceptance Criteria	PASS/FAIL
8/9/2012	KT	Mg:Si	1.0 - 2.0	1.51	PASS	2SD < 10% Mean	PASS
8/9/2012	KT	Ca:Si	1.0 - 1.75	1.39	PASS	2SD < 10% Mean	PASS
----		Fe:Si	1.0 - 2.0	1.71	PASS	2SD < 10% Mean	PASS
----		Mg:Fe	1.5 or less	0.88	PASS	N / A	N / A
8/8/2012	KT	Na:Si	1.0 - 4.0	2.78	PASS	2SD < 20% Mean	PASS
8/8/2012	KT	Al:Si	1.0 - 1.75	1.07	PASS	2SD < 10% Mean	PASS

Comments:

Detector Resolution

(Semi-Annually / Quarterly when necessary to meet TNI Standard)

Date	@Mn Kα Peak Initials	Resolution	<175?	Resolution + 2(s) <180?
8/8/2012	KT	116.1	Pass	Pass
8/17/2012	KT	139.3	Pass	Pass
8/17/2012	KT	132.2	Pass	Pass
8/21/2012	KT	125.5	Pass	Pass
8/22/2012	KT	132.1	Pass	Pass
8/23/2012	KT	134.3	Pass	Pass
8/27/2012	KT	141.7	Pass	Pass
8/28/2012	KT	135.0	Pass	Pass
8/29/2012	KT	124.5	Pass	Pass
8/31/2012	KT	135.2	Pass	Pass

Comments:

Significant Na and Resolvable Mg-Si Peaks

(Quarterly)

Date	Initials	Significant Na		Date	Initials	Resolvable Mg	Resolvable Si
8/8/2012	KT	Pass		8/8/12	KT	Yes	Yes
8/17/2012	KT	Pass		8/17/12	KT	Yes	Yes
8/17/2012	KT	Pass		8/17/12	KT	Yes	Yes
8/21/2012	KT	Pass		8/21/12	KT	Yes	Yes
8/22/2012	KT	Pass		8/22/12	KT	Yes	Yes
8/23/2012	KT	Pass		8/23/12	KT	Yes	Yes
8/27/2012	KT	Pass		8/27/12	KT	Yes	Yes
8/28/2012	KT	Pass		8/28/12	KT	Yes	Yes
8/29/2012	KT	Pass		8/29/12	KT	Yes	Yes
11/20/2012	LM	Pass		11/20/12	LM	Yes	Yes

Comments:

EMSL

Daily TEM Calibration Sheet

Month: November Year: 2011 Scope: 06.0c

Day (1-31)	Analyst Initials	Scope Align.	LN Dewar Filled	Al Peak Actual	Al Peak Accepted Limit	Cu Peak Actual	Cu Peak Accepted Limit	Pass/Fail* (circle)
1					1.47-1.49		8.03-8.05	Pass/Fail
2					1.47-1.49		8.03-8.05	Pass/Fail
3	* See	Oct	Sheet		1.47-1.49		8.03-8.05	Pass/Fail
4	ZD	✓		1.482	1.47-1.49	8.044	8.03-8.05	Pass/Fail
5	ZD	✓		1.484	1.47-1.49	8.043	8.03-8.05	Pass/Fail
6	[illegible]			1.487	1.47-1.49	8.037	8.03-8.05	Pass/Fail
7	[illegible]	✓	✓	1.487	1.47-1.49	8.035	8.03-8.05	Pass/Fail
8	[illegible]	✓	✓	1.485	1.47-1.49	8.050	8.03-8.05	Pass/Fail
9					1.47-1.49		8.03-8.05	Pass/Fail
10	[illegible]	✓		1.485	1.47-1.49	8.039	8.03-8.05	Pass/Fail
11	[illegible]	✓		1.488	1.47-1.49	8.049	8.03-8.05	Pass/Fail
12	[illegible]	✓		1.475	1.47-1.49	8.046	8.03-8.05	Pass/Fail
13	[illegible]	✓	✓	1.489	1.47-1.49	8.039	8.03-8.05	Pass/Fail
14	[illegible]	✓	✓	1.482	1.47-1.49	8.046	8.03-8.05	Pass/Fail
15	[illegible]	✓		1.485	1.47-1.49	8.046	8.03-8.05	Pass/Fail
16	[illegible]	✓		1.489	1.47-1.49	8.041	8.03-8.05	Pass/Fail
17	[illegible]			1.486	1.47-1.49	8.047	8.03-8.05	Pass/Fail
18	[illegible]	✓		1.483	1.47-1.49	8.040	8.03-8.05	Pass/Fail
19	[illegible]			1.485	1.47-1.49	8.042	8.03-8.05	Pass/Fail
20	[illegible]	✓		1.490	1.47-1.49	8.045	8.03-8.05	Pass/Fail
21	[illegible]	✓		1.490	1.47-1.49	8.037	8.03-8.05	Pass/Fail
22			✓		1.47-1.49		8.03-8.05	Pass/Fail
23	[illegible]	✓	✓	1.485	1.47-1.49	8.042	8.03-8.05	Pass/Fail
24	[illegible]	✓		1.491	1.47-1.49	8.051	8.03-8.05	Pass/Fail
25	[illegible]			1.489	1.47-1.49	8.046	8.03-8.05	Pass/Fail
26	[illegible]	✓		1.483	1.47-1.49	8.052	8.03-8.05	Pass/Fail
27					1.47-1.49		8.03-8.05	Pass/Fail
28					1.47-1.49		8.03-8.05	Pass/Fail
29					1.47-1.49		8.03-8.05	Pass/Fail
30	[illegible]	✓		1.486	1.47-1.49	8.047	8.03-8.05	Pass/Fail
31					1.47-1.49		8.03-8.05	Pass/Fail

*** Any failing results need immediate corrective action**

Monthly Report for TEM Calibrations

Laboratory: Carle Place

Scope: 06-02

Detector: PGT Avalon

Chrysotile Beam Dose Sensitivity

(Quarterly)

Date	Initials	Negative Numbers		At least 90% of patterns >15 seconds ?
		SAED	Morphology	
2/17/2010	MM	00329	00330	PASS
6/1/2010	CC	00350	00351	PASS
8/1/2010	CC	00008	00009	PASS
11/17/2010	MM	74281	74282	PASS
2/18/2011	CC	84311	84312	PASS
7/30/2011	CC	84329	84330	PASS
9/13/2011	CC	84339	84340	PASS
11/7/2011	CC	00190	0.0191	PASS
1/31/2012	TO	84385	84386	PASS
5/1/2012	TO	84445	84446	PASS
8/28/2012	MM	84504	84505	PASS
11/21/2012	CC	84531	84532	PASS

Comments:

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

Negative (Camera)					
Date	Initials	Negative Number	Camera Length	Camera Constant	Is 2 Standard Dev. < 5% Mean?
11/21/2012	CC	84537	55	21.42	PASS
5/25/2011	MM	84321	55	21.90	PASS
6/21/2011	MM	00308	55	22.09	PASS
7/30/2011	CC	84333	55	21.60	PASS
8/17/2011	CC	84336	55	20.81	PASS
9/13/2011	CC	84341	55	20.90	PASS
10/20/2011	MM/TO	89351	55	21.94	PASS
11/16/2011	TO	84370	55	22.38	PASS
12/28/2011	TO	84374	55	21.69	PASS
1/8/2012	TO	84380	55	22.65	PASS
2/3/2012	TO	84404	55	21.87	PASS
3/7/2012	CC	84413	55	22.50	PASS
3/13/2012	TO	84425	55	22.57	PASS
5/1/2012	TO	84443	55	22.35	PASS
5/22/2012	TO	84460	55	22.38	PASS
6/30/2012	MM	84483	55	21.97	PASS
7/18/2012	MM	69158	55	22.38	PASS
8/28/2012	MM	84503	55	21.98	PASS
9/24/2012	CC/MT	84510	55	21.87	PASS
10/11/2012	CC	84515	55	21.48	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Carle Place

Scope: 06-02
Detector: PGT Avalon

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

On Screen					
Date	Initials	Camera Length	Aperture #	Aperture Diameter	Is 2 Standard Dev. < 5% Mean?
4/11/2011	MM	55	4	1.23	PASS
5/25/2011	MM	55	4	1.23	PASS
6/21/2011	MM	55	4	1.23	PASS
7/30/2011	CC	55	4	1.23	PASS
8/17/2011	CC	55	4	1.23	PASS
9/13/2011	CC	55	4	1.23	PASS
10/20/2011	MM/TO	55	4	1.23	PASS
11/16/2011	TO	55	4	1.23	PASS
12/28/2011	TO	55	4	1.23	PASS
1/8/2012	TO	55	4	1.23	PASS
2/3/2012	MM	55	4	1.20	PASS
3/7/2012	CC	55	4	1.23	PASS
5/1/2012	TO	55	4	1.23	PASS
5/22/2012	TO	55	4	1.23	PASS
6/30/2012	MM	55	4	1.23	PASS
7/18/2012	MM	55	4	1.23	PASS
8/28/2012	MM	55	4	1.23	PASS
9/24/2012	CC.MT	55	4	1.20	PASS
10/11/2012	CC	55	4	1.20	PASS
11/21/2012	CC	55	4	1.23	PASS

The above aperture diameter represents the on screen diameter in reciprocal space. Multiply this number times the number of layer lines seen to get layer line spacing.

Comments:

Plasma Asher Calibration

(Quarterly)

Time To Ash 5% of Collapsed MCE Filter			
Date	Initials	Min	Sec

Comments: See Scope 06-01

Monthly Report for TEM Calibrations

Laboratory: Carle Place

Scope: 06-02

Detector: PGT Avalon

Magnification Calibrations
(Monthly)

20,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
5/25/2011	MM	18632	18480	PASS
6/21/2011	MM	18632	18468	PASS
7/30/2011	CC	18632	18225	PASS
8/17/2011	CC	18632	19440	PASS
9/13/2011	CC	18632	19305	PASS
10/20/2011	MM/TO	18632	18360	PASS
11/16/2011	TO	18632	18792	PASS
12/28/2011	TO	18632	18641	PASS
1/8/2012	TO	18632	18857	PASS
2/3/2012	TO	18632	18768	PASS
3/7/2012	CC	18632	18468	PASS
3/13/2012	TO	18632	18720	PASS
5/1/2012	TO	18632	18630	PASS
5/22/2012	TO	18632	18576	PASS
6/30/2012	MM	18632	18720	PASS
7/18/2012	MM	18632	18453	PASS
8/28/2012	MM	18632	18576	PASS
9/24/2012	CC/MT	18632	18360	PASS
10/11/2012	CC	18632	18171	PASS
11/21/2012	CC	18632	17982	PASS

Comments:

20,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
5/25/2011	MM	15123	15000	PASS
6/21/2011	MM	15123	14727	PASS
7/30/2011	CC	15123	14862	PASS
8/17/2011	CC	15123	15882	PASS
9/13/2011	CC	15123	15728	PASS
10/20/2011	MM/TO	15123	15000	PASS
11/16/2011	TO	15123	15283	PASS
12/28/2011	TO	15123	15140	PASS
1/8/2012	TO	15123	15140	PASS
2/3/2012	TO	15123	15140	PASS
3/7/2012	CC	15123	15000	PASS
3/13/2012	TO	15123	15140	PASS
5/1/2012	TO	15123	15140	PASS
5/22/2012	TO	15123	15140	PASS
6/30/2012	MM	15123	15140	PASS
7/18/2012	MM	15123	15140	PASS
8/28/2012	MM	15123	15140	PASS
9/24/2012	CC	15123	14862	PASS
10/11/2012	CC	15123	14727	PASS
11/21/2012	CC	15123	14464	PASS

Comments:

10,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
11/21/2012	CC	9805	9585	PASS
4/11/2011	MM	9805	9774	PASS
5/25/2011	MM	9805	9774	PASS
6/21/2011	MM	9805	9752	PASS
7/21/2011	CC	9805	9648	PASS
8/17/2011	CC	9805	10075	PASS
9/13/2011	CC	9805	10341	PASS
10/20/2011	MM/TO	9805	9979	PASS
11/16/2011	TO	9805	9634	PASS
12/28/2011	TO	9805	9828	PASS
1/8/2012	TO	9805	9834	PASS
2/3/2012	TO	9805	9936	PASS
3/7/2012	CC	9805	9504	PASS
5/1/2012	TO	9805	9900	PASS
5/22/2012	TO	9805	9792	PASS
6/30/2012	MM	9805	9720	PASS
7/18/2012	MM	9805	9720	PASS
8/28/2012	MM	9805	9720	PASS
9/24/2012	CC.MT	9805	9774	PASS
10/11/2012	CC	9805	9720	PASS

Comments:

10,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
4/11/2011	MM	7951	7714	PASS
5/25/2011	MM	7951	7864	PASS
6/21/2011	MM	7951	7714	PASS
7/30/2011	CC	7951	7642	PASS
10/20/2011	MM/TO	7951	7980	PASS
11/16/2011	TO	7951	7980	PASS
12/28/2011	TO	7951	7941	PASS
1/8/2012	TO	7951	7980	PASS
1/8/2012	TO	7951	7980	PASS
2/3/2012	TO	7951	8060	PASS
3/7/2012	CC	7951	7902	PASS
3/13/2012	TO	7951	8060	PASS
5/1/2012	TO	7951	8060	PASS
5/22/2012	TO	7951	8060	PASS
6/30/2012	MM	7951	8060	PASS
7/18/2012	MM	7951	8060	PASS
8/28/2012	MM	7951	8060	PASS
9/24/2012	CC	7951	7980	PASS
10/11/2012	CC	7951	7980	PASS
11/21/2012	CC	7951	7535	PASS

Comments: Data from August and September 2011 were removed due to operator error regarding eucentric positioning.

Monthly Report for TEM Calibrations

Laboratory: Carle Place

Scope: 06-02
Detector: PGT Avalon

Calibration of On Screen 0.5 and 5µm

Measuring Aids at EPA AHERA Magnification
(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
5/25/2011	MM	0.50	5.00
6/21/2011	MM	0.51	5.09
7/30/2011	CC	0.50	5.05
8/17/2011	CC	0.47	4.72
9/13/2011	CC	0.48	4.77
10/20/2011	MM/TO	0.50	5.00
11/16/2011	TO	0.49	4.91
12/28/2011	TO	0.50	4.95
1/8/2012	TO	0.50	4.95
2/3/2012	TO	0.50	4.95
3/7/2012	CC	0.50	5.00
3/13/2012	TO	0.50	4.95
5/1/2012	TO	0.50	4.95
5/22/2012	TO	0.50	4.95
6/30/2012	MM	0.50	4.95
7/18/2012	MM	0.50	4.95
8/28/2012	MM	0.50	4.95
9/24/2012	CC	0.50	5.05
10/11/2012	CC	0.51	5.09
11/21/2012	CC	0.52	5.19

Comments:

Calibration of On Screen 1.0 and 10µm

Measuring Aids at EPA 100.2 Magnification
(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
4/11/2011	MM	0.97	9.72
5/25/2011	MM	0.95	9.54
6/21/2011	MM	0.97	9.72
7/30/2011	CC	0.98	9.81
10/20/2011	MM/TO	0.94	9.40
11/16/2011	TO	0.94	9.40
12/28/2011	TO	0.94	9.44
1/8/2012	TO	0.94	9.40
1/8/2012	TO	0.94	9.40
2/3/2012	TO	0.93	9.31
3/7/2012	CC	0.95	9.49
3/13/2012	TO	0.93	9.31
5/1/2012	TO	0.93	9.31
5/22/2012	TO	0.93	9.31
6/30/2012	MM	0.93	9.31
7/18/2012	MM	0.93	9.31
8/28/2012	MM	0.93	9.31
9/24/2012	CC	0.94	9.40
10/11/2012	CC	0.94	9.40
11/21/2012	CC	1.00	9.95

Comments:

Spot Size Measurements

(Quarterly)

Date	Initials	Actual Spot	Target Spot Size	FAIL ≤250nm =	Is 2 SD <25% of
11/21/2012		166.83	≤ 250 nm	PASS	PASS
4/5/2008		246.66	≤ 250 nm	PASS	PASS
4/21/2008		174.39	≤ 250 nm	PASS	PASS
4/16/2009		209.84	≤ 250 nm	PASS	PASS
4/16/2009		200.00	≤ 250 nm	PASS	PASS
4/21/2009		158.73	≤ 250 nm	PASS	FAIL
4/21/2009		200.00	≤ 250 nm	PASS	PASS
7/9/2009		235.50	< 250 nm	PASS	PASS
11/17/2009		200.00	≤ 250 nm	PASS	PASS
2/23/2010		200.00	≤ 250 nm	PASS	PASS
6/1/2010	CO	203.71	≤ 250 nm	PASS	PASS
9/30/2010	CC	194.06	≤ 250 nm	PASS	PASS
2/18/2011	CC	203.71	≤ 250 nm	PASS	PASS
7/30/2011	CC	201.86	≤ 250 nm	PASS	PASS
9/13/2011	CC	181.30	≤ 250 nm	PASS	PASS
11/7/2011	TO	212.86	≤ 250 nm	PASS	PASS
3/7/2012	CC	189.52	≤ 250 nm	PASS	PASS
5/2/2012	TO	242.25	≤ 250 nm	PASS	PASS
8/28/2012	MM	216.77	≤ 250 nm	PASS	PASS
10/11/2012	CC	165.10	≤ 250 nm	PASS	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: Carle Place

Scope: 06-02

Detector: PGT Avalon

K Factors

(Semi-Annually)

Test Dates	Initials	Mean K Factor	Pass Criteria	Actual	PASS FAIL	Acceptance Criteria	PASS/FAIL
12/9/2012	CC	Mg:Si	1.0 - 2.0	1.80	PASS	2SD < 10% Mean	PASS
12/9/2012	CC	Ca:Si	1.0 - 1.75	1.07	PASS	2SD < 10% Mean	PASS
----		Fe:Si	1.0 - 2.0	1.30	PASS	2SD < 10% Mean	PASS
----		Mg:Fe	1.5 or less	1.39	PASS	N / A	N / A
12/4/2012	RD	Na:Si	1.0 - 4.0	3.74	PASS	2SD < 20% Mean	PASS
1/17/2012	CC	Al:Si	1.0 - 1.75	1.21	PASS	2SD < 10% Mean	PASS

Comments:

Detector Resolution

(Semi-Annually / Quarterly when necessary to meet TNI Standard)

Date	@Mn Kα Peak Initials	Resolution	<175?	Resolution + 2(s) <180?
8/1/2010	CC	154.9	Pass	Pass
2/18/2011	CC	143.2	Pass	Pass
7/30/2011	CC	143.2	Pass	Pass
9/14/2011	CC	146.9	Pass	Pass
11/7/2011	CC	144.5	Pass	Pass
12/28/2011	CC	144.5	Pass	Pass
1/28/2012	TO	134.1	Pass	Pass
5/15/2012	CC	140.9	Pass	Pass
8/30/2012	CC	147.2	Pass	Pass
11/21/2012	CC	147.2	Pass	Pass

Comments:

Significant Na and Resolvable Mg-Si Peaks

(Quarterly)

Date	Initials	Significant Na		Date	Initials	Resolvable Mg	Resolvable Si
11/17/2010	MM	Pass		8/1/10	CC	Yes	Yes
2/18/2011	CC	Pass		11/17/10	MM	Yes	Yes
7/30/2011	CC	Pass		2/18/11	CC	Yes	Yes
9/13/2011	CC	Pass		7/30/11	CC	Yes	Yes
11/7/2011	CC	Pass		9/13/11	CC	Yes	Yes
1/28/2012	TO	Pass		11/7/11	CC	Yes	Yes
5/1/2012	TO	Pass		1/31/12	TO	Yes	Yes
8/28/2012	MM	Pass		5/1/12	TO	Yes	Yes
10/9/2012	DC	Pass		8/28/12	MM	Yes	Yes
11/21/2012	CC	Pass		11/21/12	CC	Yes	Yes

Comments:

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Daily TEM Calibration Sheet

Month: October Year: 2012 Scope: 09-01

Day (1-31)	Analyst Initials	Scope Align.	LN Dewar Filled	Al Peak Actual	Al Peak Accepted Limit	Cu Peak Actual	Cu Peak Accepted Limit	Pass/Fail* (circle)
1	BK	✓	VPK	1.487	1.47-1.49	8.042	8.03-8.05	Pass/Fail
2	RG	✓	VPK	1.487	1.47-1.49	8.047	8.03-8.05	Pass/Fail
3	RG	✓		1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
4	RG	✓	VPK	1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
5	RG	✓	VPK	1.477	1.47-1.49	8.031	8.03-8.05	Pass/Fail
6	RG	✓		1.487	1.47-1.49	8.050	8.03-8.05	Pass/Fail
7					1.47-1.49		8.03-8.05	Pass/Fail
8	BK	✓	VPK	1.487	1.47-1.49	8.045	8.03-8.05	Pass/Fail
9	RG	✓	VPK	1.465	1.47-1.49	8.046	8.03-8.05	Pass/Fail
10	RG	✓	VPK	1.490	1.47-1.49	8.049	8.03-8.05	Pass/Fail
11	RG	✓	VPK	1.483	1.47-1.49	8.047	8.03-8.05	Pass/Fail
12	RG	✓	VPK	1.487	1.47-1.49	8.046	8.03-8.05	Pass/Fail
13					1.47-1.49		8.03-8.05	Pass/Fail
14					1.47-1.49		8.03-8.05	Pass/Fail
15	BK	✓	X	1.490	1.47-1.49	8.045	8.03-8.05	Pass/Fail
16	RG	✓		1.485	1.47-1.49	8.039	8.03-8.05	Pass/Fail
17	RG	✓		1.487	1.47-1.49	8.047	8.03-8.05	Pass/Fail
18	RG	✓		1.484	1.47-1.49	8.047	8.03-8.05	Pass/Fail
19			LR		1.47-1.49		8.03-8.05	Pass/Fail
20	MP			1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
21	BK	✓		1.483	1.47-1.49	8.050	8.03-8.05	Pass/Fail
22			MZ		1.47-1.49		8.03-8.05	Pass/Fail
23	RG	✓	MZ	1.485	1.47-1.49	8.046	8.03-8.05	Pass/Fail
24	RG	✓	MZ	1.486	1.47-1.49	8.045	8.03-8.05	Pass/Fail
25	RG	✓		1.486	1.47-1.49	8.047	8.03-8.05	Pass/Fail
26	RG	✓	MZ	1.465	1.47-1.49	8.046	8.03-8.05	Pass/Fail
27	RG	✓		1.481	1.47-1.49	8.046	8.03-8.05	Pass/Fail
28			KC		1.47-1.49		8.03-8.05	Pass/Fail
29			MZ		1.47-1.49		8.03-8.05	Pass/Fail
30	BK	✓	BK	1.488	1.47-1.49	8.050	8.03-8.05	Pass/Fail
31			MZ		1.47-1.49		8.03-8.05	Pass/Fail

*** Any failing results need immediate corrective action**

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Daily TEM Calibration Sheet

Month: Sept Year: 2012 Scope: 09-02

Day (1-31)	Analyst Initials	Scope Align.	LN Dewar Filled	Al Peak Actual	Al Peak Accepted Limit	Cu Peak Actual	Cu Peak Accepted Limit	Pass/Fail* (circle)
1					1.47-1.49		8.03-8.05	Pass/Fail
2	BK	✓	✓	1.483	1.47-1.49	8.041	8.03-8.05	Pass/Fail
3	~~BK~~				1.47-1.49		8.03-8.05	Pass/Fail
4	KD	X	VPK	1.47	1.47-1.49	8.05	8.03-8.05	Pass/Fail
5			VPK		1.47-1.49		8.03-8.05	Pass/Fail
6			VPK		1.47-1.49		8.03-8.05	Pass/Fail
7	KD	X	VPK	1.47	1.47-1.49	8.05	8.03-8.05	Pass/Fail
8	KD	X	X	1.48	1.47-1.49	8.03	8.03-8.05	Pass/Fail
9	KD	X	X	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
10	KD	X	VPK	1.48	1.47-1.49	8.03	8.03-8.05	Pass/Fail
11	KD	X	VPK	1.48	1.47-1.49	8.03	8.03-8.05	Pass/Fail
12	KD	X	VPK	1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
13	KD	X	VPK	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
14			VPK		1.47-1.49		8.03-8.05	Pass/Fail
15					1.47-1.49		8.03-8.05	Pass/Fail
16	KD	X	X	1.48	1.47-1.49	8.03	8.03-8.05	Pass/Fail
17	KD	X	VPK	1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
18	KD	X	VPK	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
19	KD	X	VPK	1.48	1.47-1.49	8.05	8.03-8.05	Pass/Fail
20	KD	X	VPK	1.48	1.47-1.49	8.05	8.03-8.05	Pass/Fail
21	KD	X	VPK	1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
22	KD	X		1.49	1.47-1.49	8.03	8.03-8.05	Pass/Fail
23	KD	X	BK ✓	1.47	1.47-1.49	8.04	8.03-8.05	Pass/Fail
24			VPK		1.47-1.49		8.03-8.05	Pass/Fail
25	KD	X	VPK	1.49	1.47-1.49	8.03	8.03-8.05	Pass/Fail
26	KD	X	VPK	1.48	1.47-1.49	8.05	8.03-8.05	Pass/Fail
27	KD	X	VPK	1.47	1.47-1.49	8.04	8.03-8.05	Pass/Fail
28	KD	✓	VPK	1.485	1.47-1.49	8.045	8.03-8.05	Pass/Fail
29					1.47-1.49		8.03-8.05	Pass/Fail
30	KD	X	BK	1.47	1.47-1.49	8.05	8.03-8.05	Pass/Fail
31					1.47-1.49		8.03-8.05	Pass/Fail

*** Any failing results need immediate corrective action**

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Daily TEM Calibration Sheet

Month: Oct. 1 2012 Year: _____ Scope: 09-0.2

Day (1-31)	Analyst Initials	Scope Align.	LN Dewar Filled	Al Peak Actual	Al Peak Accepted Limit	Cu Peak Actual	Cu Peak Accepted Limit	Pass/Fail* (circle)
1			PK V		1.47-1.49		8.03-8.05	Pass/Fail
2	KD	X	VPK	1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
3	KD	X		1.47	1.47-1.49	8.05	8.03-8.05	Pass/Fail
4	KD	X	VPK	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
5			VPK		1.47-1.49		8.03-8.05	Pass/Fail
6					1.47-1.49		8.03-8.05	Pass/Fail
7	KD	X		1.47	1.47-1.49	8.03	8.03-8.05	Pass/Fail
8	KD	X	VPK	1.48	1.47-1.49	8.05	8.03-8.05	Pass/Fail
9	KD	X	VPK	1.47	1.47-1.49	8.04	8.03-8.05	Pass/Fail
10	KD	X	VPK	1.48	1.47-1.49	8.03	8.03-8.05	Pass/Fail
11	KD	X	VPK	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail
12			VPK		1.47-1.49		8.03-8.05	Pass/Fail
13					1.47-1.49		8.03-8.05	Pass/Fail
14	KD	X		1.48	1.47-1.49	8.05	8.03-8.05	Pass/Fail
15	KD	X	X	1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
16	KD	X		1.48	1.47-1.49	8.03	8.03-8.05	Pass/Fail
17	KD	X		1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
18	KD	X	MZ	1.47	1.47-1.49	8.03	8.03-8.05	Pass/Fail
19	MP	✓	MZ	1.487	1.47-1.49	8.03	8.03-8.05	Pass/Fail
20					1.47-1.49		8.03-8.05	Pass/Fail
21	KD	X		1.48	1.47-1.49	8.04	8.03-8.05	Pass/Fail
22	KD	X	MZ	1.47	1.47-1.49	8.04	8.03-8.05	Pass/Fail
23	KD	X	MZ	1.48	1.47-1.49	8.05	8.03-8.05	Pass/Fail
24	M		MZ	1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
25	BK	✓	I	1.484	1.47-1.49	8.039	8.03-8.05	Pass/Fail
26	TP			1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
27	MP			1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
28	KD	X	KC	1.49	1.47-1.49	8.05	8.03-8.05	Pass/Fail
29	KC		MZ		1.47-1.49		8.03-8.05	Pass/Fail
30	KD	X	MZ	1.47	1.47-1.49	8.03	8.03-8.05	Pass/Fail
31	KD	X	MZ	1.49	1.47-1.49	8.04	8.03-8.05	Pass/Fail

*** Any failing results need immediate corrective action**

Monthly Report for TEM Calibrations

Laboratory: San Leandro

Scope: 09-01
Detector: #139

Chrysotile Beam Dose Sensitivity

(Quarterly)

Date	Initials	Negative Numbers		At least 90% of patterns >15 seconds ?
		SAED	Morphology	
9/9/2009	BK	7915	7917	PASS
12/13/2009	BK	7980	7981	PASS
3/21/2010	BK	18005	18006	PASS
6/24/2010	BK	18032	18030	PASS
9/19/2010	BK	7503	7504	PASS
12/27/2010	BK	18121	18122	PASS
7/6/2011	BK	18351	7621	PASS
11/9/2011	KD	18446	18447	PASS
1/5/2012	KD	18458	18459	PASS
3/4/2012	KD	18468	18469	PASS
8/9/2012	KD	18497	18498	PASS
11/4/2012	KD	18523	18524	PASS

Comments:

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

Negative (Camera)					
Date	Initials	Negative Number	Camera Length	Camera Constant	Is 2 Standard Dev. < 5% Mean?
1/25/2011	BK	18129	55	22.27	PASS
2/26/2011	np	18158	55	21.97	PASS
4/7/2011	NP	18246	55	21.73	PASS
7/6/2011	np	18350	55	23.59	PASS
8/17/2011	BK	18411	55	22.26	PASS
9/3/2011	NP	18417	55	22.07	PASS
10/30/2011	KD	18436	55	22.71	PASS
11/6/2011	KD	18443	55	22.53	PASS
12/13/2011	KD	18451	55	22.77	PASS
1/4/2012	KD	18454	55	22.33	PASS
2/9/2012	KD	18460	55	22.53	PASS
3/4/2012	KD	18465	55	22.51	PASS
5/7/2012	KD	18473	55	22.89	PASS
6/4/2012	KD	18478	55	22.44	PASS
7/11/2012	KD	18487	55	22.49	PASS
8/7/2012	KD	18494	55	22.57	PASS
9/30/2012	KD	18501	55	22.22	PASS
10/17/2012	KD	18514	55	22.51	PASS
11/4/2012	KD	18519	55	22.70	PASS
12/3/2012	KD	18524	55	24.34	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: San Leandro

Scope: 09-01
Detector: #139

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

On Screen					
Date	Initials	Camera Length	Aperture #	Aperture Diameter	Is 2 Standard Dev. < 5% Mean?
2/26/2011	np	22	3	0.88	PASS
4/7/2011	NP	22	3	0.88	PASS
7/6/2011	np	22	3	0.85	PASS
8/17/2011	BK	22	3	0.88	PASS
8/17/2011	BK	22	3	0.88	PASS
9/3/2011	NP	22	3	0.88	PASS
10/30/2011	KD	22	3	0.88	PASS
11/6/2011	KD	22	3	0.88	PASS
12/13/2011	KD	22	3	0.87	PASS
1/4/2012	KD	22	3	0.88	PASS
2/2/2012	BK	22	3	0.88	PASS
3/4/2012	KD	22	3	0.88	PASS
5/7/2012	KD	22	3	0.88	PASS
6/4/2012	KD	22	3	0.88	PASS
7/11/2012	KD	22	3	0.88	PASS
8/9/2012	KD	22	3	0.88	PASS
9/30/2012	KD	22	3	0.88	PASS
10/17/2012	KD	22	3	0.88	PASS
11/4/2012	KD	22	3	0.88	PASS
12/3/2012	KD	22	3	0.88	PASS

The above aperture diameter represents the on screen diameter in reciprocal space. Multiply this number times the number of layer lines seen to get layer line spacing.

Comments:

Plasma Asher Calibration

(Quarterly)

Time To Ash 5% of Collapsed MCE Filter			
Date	Initials	Min	Sec
8/23/2010	IO	5	25
11/29/2010	IO	8	02
3/17/2011	NP	5	22
7/27/2011	NP	4	47
11/8/2011	KD	4	32
1/5/2012	KD	4	10
3/1/2012	KD	7	32
7/15/2012	KD	6	21
9/11/2012	KD	6	27
11/15/2012	KD	4	44

Comments:

Monthly Report for TEM Calibrations

Laboratory: San Leandro

Scope: 09-01
Detector: #139

Magnification Calibrations
(Monthly)

20,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
1/25/2011	BK	18826	18540	PASS
2/26/2011	NP	18826	19872	PASS
4/7/2011	NP	18826	17682	PASS
5/26/2011	np	18826	19008	PASS
7/6/2011	np	18826	18720	PASS
8/17/2011	BK	18826	18720	PASS
9/3/2011	NP	18826	18720	PASS
10/30/2011	KD	18826	18851	PASS
11/6/2011	KD	18826	18949	PASS
12/13/2011	KD	18826	18871	PASS
1/4/2012	KD	18826	18851	PASS
2/9/2012	KD	18826	18949	PASS
3/4/2012	KD	18826	18753	PASS
5/7/2012	KD	18826	18851	PASS
6/4/2012	KD	18826	18949	PASS
7/11/2012	KD	18826	18851	PASS
8/7/2012	KD	18826	18655	PASS
9/18/2012	KD	18826	18900	PASS
10/17/2012	KD	18826	19008	PASS
11/4/2012	KD	18826	18949	PASS

Comments:

20,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
2/26/2011	NP	15052	15369	PASS
4/7/2011	NP	15052	15223	PASS
5/26/2011	NP	15052	14800	PASS
7/6/2011	NP	15052	14531	PASS
8/17/2011	BK	15052	14800	PASS
9/3/2011	NP	15052	14938	PASS
10/30/2011	KD	15052	15079	PASS
11/6/2011	KD	15052	15079	PASS
12/13/2011	KD	15052	15223	PASS
1/4/2012	KD	15052	15079	PASS
2/9/2012	KD	15052	15296	PASS
3/4/2012	KD	15052	15079	PASS
5/7/2012	KD	15052	14938	PASS
6/4/2012	KD	15052	15079	PASS
7/11/2012	KD	15052	14938	PASS
8/7/2012	KD	15052	14938	PASS
9/18/2012	KD	15052	15223	PASS
10/17/2012	KD	15052	15223	PASS
11/4/2012	KD	15052	15151	PASS
12/3/2012	KD	15052	14938	PASS

Comments:

10,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
1/25/2011	BK	9925	9954	PASS
2/26/2011	NP	9925	9720	PASS
4/7/2011	NP	9925	9259	PASS
5/26/2011	np	9925	9958	PASS
7/6/2011	NP	9925	9983	PASS
8/17/2011	BK	9925	9995	PASS
9/3/2011	NP	9925	10021	PASS
10/30/2011	KD	9925	9977	PASS
11/6/2011	KD	9925	9956	PASS
12/13/2011	KD	9925	9916	PASS
1/4/2012	KD	9925	10309	PASS
2/9/2012	KD	9925	10002	PASS
3/4/2012	KD	9925	9833	PASS
5/7/2012	KD	9925	9887	PASS
6/4/2012	KD	9925	9908	PASS
7/11/2012	KD	9925	10105	PASS
8/7/2012	KD	9925	9945	PASS
9/18/2012	KD	9925	9927	PASS
10/17/2012	KD	9925	9926	PASS
11/4/2012	KD	9925	9818	PASS

Comments:

10,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
2/26/2011	NP	7920	7992	PASS
4/7/2011	NP	7920	7797	PASS
5/26/2011	np	7920	7992	PASS
7/6/2011	NP	7920	7434	PASS
8/17/2011	NP	7920	7992	PASS
9/3/2011	NP	7920	7611	PASS
10/30/2011	KD	7920	7992	PASS
11/6/2011	KD	7920	7992	PASS
12/13/2011	KD	7920	7952	PASS
1/4/2012	KD	7920	7972	PASS
2/9/2012	KD	7920	7992	PASS
3/4/2012	KD	7920	7952	PASS
5/7/2012	KD	7920	7952	PASS
6/4/2012	KD	7920	7992	PASS
7/11/2012	KD	7920	7992	PASS
8/7/2012	KD	7920	7972	PASS
9/18/2012	KD	7920	7972	PASS
10/17/2012	KD	7920	7972	PASS
11/4/2012	KD	7920	7952	PASS
12/3/2012	KD	7920	7952	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: San Leandro

Scope: 09-01
Detector: #139

Calibration of On Screen 0.5 and 5µm Measuring Aids at EPA AHERA Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
2/26/2011	NP	0.49	4.81
4/7/2011	NP	0.49	4.86
5/26/2011	NP	0.51	5.00
7/6/2011	NP	0.52	5.09
8/17/2011	BK	0.51	5.00
9/3/2011	NP	0.50	4.95
10/30/2011	KD	0.50	4.91
11/6/2011	KD	0.50	4.91
12/13/2011	KD	0.49	4.86
1/4/2012	KD	0.50	4.91
2/9/2012	KD	0.49	4.84
3/4/2012	KD	0.50	4.91
5/7/2012	KD	0.50	4.95
6/4/2012	KD	0.50	4.91
7/11/2012	KD	0.50	4.95
8/7/2012	KD	0.50	4.95
9/18/2012	KD	0.49	4.86
10/17/2012	KD	0.49	4.86
11/4/2012	KD	0.50	4.88
12/3/2012	KD	0.50	4.95

Comments:

Calibration of On Screen 1.0 and 10µm Measuring Aids at EPA 100.2 Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
2/26/2011	NP	0.94	9.26
4/7/2011	NP	0.96	9.49
5/26/2011	np	0.94	9.26
7/6/2011	NP	1.01	9.95
8/17/2011	NP	0.94	9.26
9/3/2011	NP	0.99	9.72
10/30/2011	KD	0.94	9.26
11/6/2011	KD	0.94	9.26
12/13/2011	KD	0.94	9.31
1/4/2012	KD	0.94	9.28
2/9/2012	KD	0.94	9.26
3/4/2012	KD	0.94	9.31
5/7/2012	KD	0.94	9.31
6/4/2012	KD	0.94	9.26
7/11/2012	KD	0.94	9.26
8/7/2012	KD	0.94	9.28
9/18/2012	KD	0.94	9.28
10/17/2012	KD	0.94	9.28
11/4/2012	KD	0.94	9.31
12/3/2012	KD	0.94	9.31

Comments:

Spot Size Measurements

(Quarterly)

Date	Initials	Actual Spot	Target Spot Size	FAIL ≤250nm =	Is 2 SD
6/13/2008	KF	136.01	≤ 250 nm	PASS	PASS
9/30/2008	KF	167.21	≤ 250 nm	PASS	PASS
3/30/2009	AT	144.32	≤ 250 nm	PASS	PASS
7/21/2009	BK	176.30	≤ 250 nm	PASS	PASS
10/21/2009	BK	182.26	≤ 250 nm	PASS	PASS
11/9/2009	BK	176.90	≤ 250 nm	PASS	PASS
2/23/2010	BK	171.54	≤ 250 nm	PASS	PASS
5/26/2010	BK	175.97	< 250 nm	PASS	PASS
8/15/2010	BK	187.87	≤ 250 nm	PASS	PASS
11/29/2010	BK	161.84	≤ 250 nm	PASS	PASS
2/26/2011	NP	150.97	≤ 250 nm	PASS	PASS
3/17/2011	NP	150.97	≤ 250 nm	PASS	PASS
4/7/2011	NP	167.67	≤ 250 nm	PASS	PASS
7/27/2011	NP	200.32	≤ 250 nm	PASS	PASS
9/3/2011	NP	144.68	≤ 250 nm	PASS	PASS
10/30/2011	KD	173.31	≤ 250 nm	PASS	PASS
2/9/2012	KD	158.32	≤ 250 nm	PASS	PASS
3/4/2012	KD	159.97	≤ 250 nm	PASS	PASS
6/4/2012	KD	195.26	≤ 250 nm	PASS	PASS
10/17/2012	KD	157.83	≤ 250 nm	PASS	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: San Leandro

Scope: 09-01

Detector: #139

K Factors

(Semi-Annually)

Test Dates	Initials	Mean K Factor	Pass Criteria	Actual	PASS FAIL	Acceptance Criteria	PASS/FAIL
6/4/2012	KD	Mg:Si	1.0 - 2.0	1.63	PASS	2SD < 10% Mean	PASS
7/12/2012	KD	Ca:Si	1.0 - 1.75	1.09	PASS	2SD < 10% Mean	PASS
---		Fe:Si	1.0 - 2.0	1.35	PASS	2SD < 10% Mean	PASS
---		Mg:Fe	1.5 or less	1.21	PASS	N / A	N / A
8/7/2012	KD	Na:Si	1.0 - 4.0	3.42	PASS	2SD < 20% Mean	PASS
8/7/2012	KD	Al:Si	1.0 - 1.75	1.09	PASS	2SD < 10% Mean	PASS

Comments:

Detector Resolution

(Semi-Annually / Quarterly when necessary to meet TNI Standard)

Date	@Mn Kα Peak Initials	Resolution	<175?	Resolution + 2(s) <180?
3/8/2009	KF	132.9	Pass	Pass
5/14/2009	KF	149.6	Pass	Pass
11/17/2009	BK	135.4	Pass	Pass
5/25/2010	BK	145.6	Pass	Pass
11/29/2010	BK	150.4	Pass	Pass
8/2/2011	NP	136.5	Pass	Pass
1/5/2012	KD	146.5	Pass	Pass
6/4/2012	KD	144.3	Pass	Pass

Comments:

Significant Na and Resolvable Mg-Si Peaks

(Quarterly)

Date	Initials	Significant Na		Date	Initials	Resolvable Mg	Resolvable Si
7/14/2010	BK	Pass		7/14/10	BK	Yes	Yes
10/24/2010	BK	Pass		10/24/10	BK	Yes	Yes
1/25/2011	BK	Pass		1/25/11	BK	Yes	Yes
4/7/2011	NP	Pass		4/7/11	NP	Yes	Yes
7/7/2011	NP	Pass		7/7/11	NP	Yes	Yes
11/9/2011	KD	Pass		11/9/11	KD	Yes	Yes
1/5/2012	KD	Pass		1/5/12	KD	Yes	Yes
3/4/2012	KD	Pass		3/4/12	KD	Yes	Yes
8/7/2012	KD	Pass		8/7/12	KD	Yes	Yes
11/7/2012	np	Pass		11/4/12	KD	Yes	Yes

Comments:

Monthly Report for TEM Calibrations

Laboratory: San Leandro

Scope: 09-2

Detector: N-1560

Chrysotile Beam Dose Sensitivity

(Quarterly)

Date	Initials	Negative Numbers		At least 90% of patterns >15 seconds ?
		SAED	Morphology	
6/29/2010	BK	20289	20290	PASS
9/19/2010	BK	20305	20306	PASS
12/27/2010	BK	20320	20321	PASS
3/1/2011	NP	42594	42598	PASS
8/5/2011	NP	60804	60805	PASS
11/9/2011	KD	42730	42731	PASS
1/11/2012	KD	42751	42750	PASS
3/1/2012	KD	42781	42782	PASS
4/15/2012	KD	43798	43800	PASS
6/2/2012	KD	43830	43831	PASS
9/11/2012	KD	43877	43878	PASS
11/4/2012	KD	44031	44032	PASS

Comments:

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

Negative (Camera)					
Date	Initials	Negative Number	Camera Length	Camera Constant	Is 2 Standard Dev. < 5% Mean?
5/26/2011	np	42648	55	23.36	PASS
6/22/2011	np	42655	55	23.52	PASS
7/22/2011	NP	42672	55	23.29	PASS
8/29/2011	BK	42700	55	23.46	PASS
9/16/2011	NP	42706	55	23.17	PASS
10/30/2011	KD	42720	55	23.78	PASS
11/6/2011	KD	42725	55	23.96	PASS
12/13/2011	KD	42733	55	23.25	PASS
1/4/2012	KD	42743	55	23.59	PASS
2/8/2012	KD	42767	55	23.69	PASS
3/1/2012	KD	42780	55	23.71	PASS
4/15/2012	KD	42792	55	23.71	PASS
5/7/2012	KD	43813	55	23.89	PASS
6/2/2012	KD	43827	55	23.83	PASS
7/11/2012	KD	43841	55	24.13	PASS
8/7/2012	KD	43857	55	23.50	PASS
9/11/2012	KD	43873	55	23.93	PASS
10/16/2012	KD	44010	55	23.80	PASS
11/4/2012	KD	44028	55	24.10	PASS
12/3/2012	KD	44042	55	23.88	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: San Leandro

Scope: 09-2

Detector: N-1560

Camera Constant Calibrations

(Monthly / Weekly when Water Analysis is performed)

On Screen					
Date	Initials	Camera Length	Aperture #	Aperture Diameter	Is 2 Standard Dev. < 5% Mean?
4/7/2011	NP	22	1	1.36	PASS
5/26/2011	np	22	1	1.36	PASS
6/22/2011	np	22	1	1.36	PASS
8/5/2011	NP	22	1	1.39	PASS
10/30/2011	KD	22	1	1.36	PASS
11/6/2011	KD	22	1	1.36	PASS
12/13/2011	KD	22	1	1.36	PASS
1/4/2012	KD	22	1	1.36	PASS
1/29/2012	KD	22	1	1.33	PASS
2/8/2012	KD	22	1	1.33	PASS
3/1/2012	KD	22	1	1.29	PASS
4/15/2012	KD	22	1	1.33	PASS
5/3/2012	KD	22	1	1.29	PASS
6/2/2012	KD	22	1	1.33	PASS
7/11/2012	KD	22	1	1.33	PASS
8/7/2012	KD	22	1	1.33	PASS
9/16/2012	KD	22	1	1.33	PASS
10/16/2012	KD	22	1	1.33	PASS
11/4/2012	KD	22	1	1.33	PASS
12/3/2012	KD	22	1	1.33	PASS

The above aperture diameter represents the on screen diameter in reciprocal space. Multiply this number times the number of layer lines seen to get layer line spacing.

Comments:

Plasma Asher Calibration

(Quarterly)

Time To Ash 5% of Collapsed MCE Filter			
Date	Initials	Min	Sec
8/23/2010	IO	5	25
11/29/2010	IO	8	02
3/7/2011	NP	5	22
7/27/2011	NP	4	47
11/8/2011	KD	4	32
1/5/2012	KD	5	06
3/1/2012	KD	4	10
7/15/2012	KD	6	21
9/11/2012	KD	6	27
11/15/2012	KD	4	44

Comments:

Monthly Report for TEM Calibrations

Laboratory: San Leandro

Scope: 09-2

Detector: N-1560

Magnification Calibrations
(Monthly)

20,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
4/7/2011	NP	19268	18986	PASS
5/17/2011	BK	19268	19145	PASS
6/22/2011	NP	19268	19322	PASS
7/27/2011	NP	19268	19636	PASS
8/29/2011	BK	19268	19047	PASS
9/21/2011	NP	19268	20520	PASS
10/30/2011	KD	19268	19116	PASS
11/6/2011	KD	19268	19047	PASS
12/13/2011	KD	19268	19152	PASS
1/4/2012	KD	19268	19080	PASS
2/8/2012	KD	19268	19244	PASS
3/1/2012	KD	19268	19350	PASS
4/15/2012	KD	19268	19047	PASS
5/7/2012	KD	19268	19125	PASS
6/2/2012	KD	19268	19195	PASS
7/11/2012	KD	19268	19350	PASS
8/7/2012	KD	19268	19350	PASS
9/11/2012	KD	19268	19332	PASS
10/16/2012	KD	19268	19047	PASS
11/4/2012	KD	19268	19418	PASS

Comments:

20,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
5/17/2011	BK	15684	15518	PASS
6/22/2011	np	15684	15671	PASS
7/27/2011	NP	15684	15518	PASS
8/29/2011	BK	15684	15369	PASS
9/16/2011	NP	15684	15671	PASS
10/30/2011	KD	15684	15518	PASS
11/6/2011	KD	15684	15671	PASS
12/12/2011	KD	15684	15671	PASS
1/9/2012	KD	15684	15748	PASS
2/8/2012	KD	15684	15826	PASS
3/1/2012	KD	15684	15826	PASS
4/15/2012	KD	15684	15671	PASS
5/7/2012	KD	15684	15671	PASS
6/2/2012	KD	15684	15748	PASS
7/11/2012	KD	15684	15826	PASS
8/7/2012	KD	15684	15826	PASS
9/11/2012	KD	15684	15748	PASS
10/16/2012	KD	15684	15671	PASS
11/4/2012	KD	15684	15826	PASS
12/3/2012	KD	15684	15594	PASS

Comments:

10,000x - Negative

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
4/7/2011	NP	10870	10832	PASS
5/17/2011	BK	10870	10823	PASS
6/22/2011	BK	10870	10851	PASS
7/27/2011	NP	10870	11040	PASS
8/29/2011	BK	10870	10800	PASS
9/16/2011	NP	10870	11340	PASS
10/30/2011	KD	10870	10800	PASS
11/6/2011	KD	10870	10851	PASS
12/13/2011	KD	10870	10250	PASS
1/4/2012	KD	10870	10800	PASS
2/8/2012	KD	10870	10800	PASS
3/1/2012	KD	10870	10954	PASS
4/15/2012	KD	10870	11438	PASS
5/7/2012	KD	10870	10719	PASS
6/2/2012	KD	10870	10893	PASS
7/11/2012	KD	10870	10800	PASS
8/7/2012	KD	10870	10839	PASS
9/11/2012	KD	10870	10839	PASS
10/16/2012	KD	10870	10857	PASS
11/4/2012	KD	10870	10971	PASS

Comments:

10,000x - Screen

Date	Initials	Target Mag	Actual Mag	Is 2 SD <5% of Mean?
5/17/2011	BK	8820	8855	PASS
6/22/2011	np	8820	8782	PASS
7/27/2011	NP	8820	8880	PASS
8/29/2011	BK	8820	8782	PASS
9/16/2011	NP	8820	8880	PASS
10/30/2011	KD	8820	8782	PASS
11/6/2011	KD	8820	8905	PASS
12/12/2011	KD	8820	8831	PASS
1/4/2012	KD	8820	8782	PASS
2/8/2012	KD	8820	8831	PASS
3/1/2012	KD	8820	8687	PASS
4/15/2012	KD	8820	8831	PASS
5/7/2012	KD	8820	8734	PASS
6/2/2012	KD	8820	8807	PASS
7/11/2012	KD	8820	8831	PASS
8/7/2012	KD	8820	8880	PASS
9/11/2012	KD	8820	8831	PASS
10/16/2012	KD	8820	8831	PASS
11/4/2012	KD	8820	8831	PASS
12/3/2012	KID	8820	8782	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: San Leandro

Scope: 09-2
Detector: N-1560

Calibration of On Screen 0.5 and 5µm Measuring Aids at EPA AHERA Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
5/17/2011	BK	0.48	4.77
6/22/2011	np	0.48	4.72
7/27/2011	NP	0.48	4.77
8/29/2011	BK	0.49	4.81
9/16/2011	NP	0.48	4.72
10/30/2011	KD	0.48	4.77
11/6/2011	KD	0.48	4.72
12/12/2011	KD	0.48	4.72
1/9/2012	KD	0.48	4.70
2/8/2012	KD	0.47	4.68
3/1/2012	KD	0.47	4.68
4/15/2012	KD	0.48	4.72
5/7/2012	KD	0.48	4.72
6/2/2012	KD	0.48	4.70
7/11/2012	KD	0.47	4.68
8/7/2012	KD	0.47	4.68
9/11/2012	KD	0.48	4.70
10/16/2012	KD	0.48	4.72
11/4/2012	KD	0.47	4.68
12/3/2012	KD	0.48	4.75

Comments:

Calibration of On Screen 1.0 and 10µm Measuring Aids at EPA 100.2 Magnification

(Monthly)

Date	Initials	Small Circle microns	Large Circle microns
5/17/2011	BK	0.85	8.36
6/22/2011	np	0.85	8.43
7/27/2011	NP	0.84	8.33
8/29/2011	BK	0.85	8.43
9/16/2011	NP	0.84	8.33
10/30/2011	KD	0.85	8.43
11/6/2011	KD	0.84	8.31
12/12/2011	KD	0.85	8.38
1/4/2012	KD	0.85	8.43
2/8/2012	KD	0.85	8.38
3/1/2012	KD	0.86	8.52
4/15/2012	KD	0.85	8.38
5/7/2012	KD	0.86	8.47
6/2/2012	KD	0.85	8.40
7/11/2012	KD	0.85	8.38
8/7/2012	KD	0.84	8.33
9/11/2012	KD	0.85	8.38
10/16/2012	KD	0.85	8.38
11/4/2012	KD	0.85	8.38
12/3/2012	KID	0.85	8.43

Comments:

Spot Size Measurements

(Quarterly)

Date	Initials	Actual Spot	Target Spot Size	FAIL ≤250nm =	Is 2 SD <25% of
7/15/2009	KD	130.05	≤ 250 nm	PASS	PASS
10/19/2009	BK	144.91	≤ 250 nm	PASS	PASS
10/22/2009	BK	155.10	≤ 250 nm	PASS	PASS
1/20/2010	BK	140.02	≤ 250 nm	PASS	PASS
4/27/2010	BK	155.47	≤ 250 nm	PASS	PASS
7/13/2010	BK	166.15	≤ 250 nm	PASS	PASS
10/24/2010	BK	140.85	≤ 250 nm	PASS	PASS
1/27/2011	BK	156.58	< 250 nm	PASS	PASS
3/9/2011	NP	149.34	≤ 250 nm	PASS	PASS
4/7/2011	NP	125.94	≤ 250 nm	PASS	PASS
6/22/2011	np	120.42	≤ 250 nm	PASS	PASS
7/27/2011	NP	134.42	≤ 250 nm	PASS	PASS
8/17/2011	NP	127.32	≤ 250 nm	PASS	PASS
11/6/2011	KD	157.51	≤ 250 nm	PASS	PASS
1/4/2012	KD	157.23	≤ 250 nm	PASS	PASS
3/1/2012	KD	124.19	≤ 250 nm	PASS	PASS
3/1/2012	KD	155.04	≤ 250 nm	PASS	PASS
6/2/2012	KD	182.58	≤ 250 nm	PASS	PASS
9/11/2012	KD	123.79	≤ 250 nm	PASS	PASS
11/4/2012	KD	154.50	≤ 250 nm	PASS	PASS

Comments:

Monthly Report for TEM Calibrations

Laboratory: San Leandro

Scope: 09-2

Detector: N-1560

K Factors

(Semi-Annually)

Test Dates	Initials	Mean K Factor	Pass Criteria	Actual	PASS FAIL	Acceptance Criteria	PASS/FAIL
6/2/2012	KD	Mg:Si	1.0 - 2.0	1.78	PASS	2SD < 10% Mean	PASS
11/12/2012	KD	Ca:Si	1.0 - 1.75	1.13	PASS	2SD < 10% Mean	PASS
----		Fe:Si	1.0 - 2.0	1.45	PASS	2SD < 10% Mean	PASS
----		Mg:Fe	1.5 or less	1.23	PASS	N / A	N / A
8/7/2012	KD	Na:Si	1.0 - 4.0	3.75	PASS	2SD < 20% Mean	PASS
1/11/2012	KD	Al:Si	1.0 - 1.75	1.23	PASS	2SD < 10% Mean	PASS

Comments:

Detector Resolution

(Semi-Annually / Quarterly when necessary to meet TNI Standard)

Date	@Mn Kα Peak Initials	Resolution	<175?	Resolution + 2(s) <180?
6/30/2009	KD	138.4	Pass	Pass
7/14/2009	KD	154.6	Pass	Pass
7/15/2009	BK	136.8	Pass	Pass
1/20/2010	BK	139.3	Pass	Pass
4/27/2010	BK	141.1	Pass	Pass
10/24/2010	BK	139.2	Pass	Pass
1/25/2011	NP	143.9	Pass	Pass
8/2/2011	NP	148.3	Pass	Pass
1/8/2012	KD	150.1	Pass	Pass
6/2/2012	KD	133.5	Pass	Pass

Comments:

Significant Na and Resolvable Mg-Si Peaks

(Quarterly)

Date	Initials	Significant Na		Date	Initials	Resolvable Mg	Resolvable Si
10/24/2010	BK	Pass		1/25/11	NP	Yes	Yes
1/25/2011	NP	Pass		4/7/11	NP	Yes	Yes
7/15/2011	NP	Pass		7/15/11	NP	Yes	Yes
11/9/2011	KD	Pass		11/9/11	KD	Yes	Yes
1/11/2012	KD	Pass		1/11/12	KD	Yes	Yes
3/1/2012	KD	Pass		3/1/12	KD	Yes	Yes
4/15/2012	KD	Pass		4/16/12	KD	Yes	Yes
6/2/2012	KD	Pass		6/2/12	KD	Yes	Yes
9/11/2012	KD	Pass		9/11/12	KD	Yes	Yes
11/4/2012	KD	Pass		11/4/12	KD	Yes	Yes

Comments:

7. NVLAP/AIHA Certifications

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-3

EMSL Analytical, Inc.

San Leandro, CA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

AIRBORNE ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2012-07-01 through 2013-06-30

Effective dates

DEPARTMENT OF COMMERCE ★ UNITED STATES OF AMERICA ★

For the National Institute of Standards and Technology

National Voluntary
Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
2235 Polvorosa Avenue, Suite 230
San Leandro, CA 94577
Baojia Ke, Ph.D.
Phone: 510-895-3675 Fax: 510-895-3680
E-Mail: ssiegel@emsl.com
URL: http://www.emsl.com

AIRBORNE ASBESTOS FIBER ANALYSIS (TEM) **NVLAP LAB CODE 101048-3**

NVLAP Code	*Designation / Description*
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

NVLAP-01S (REV. 2005-05-19)

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-3

EMSL Analytical, Inc.

San Leandro, CA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

National Voluntary
Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
2235 Polvorosa Avenue, Suite 230
San Leandro, CA 94577
Baojia Ke, Ph.D.
Phone: 510-895-3675 Fax: 510-895-3680
E-Mail: ssiegel@emsl.com
URL: http://www.emsl.com

BULK ASBESTOS FIBER ANALYSIS (PLM) **NVLAP LAB CODE 101048-3**

NVLAP Code	*Designation / Description*
18/A01	EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

NVLAP-01S (REV. 2005-05-19)

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-0

EMSL Analytical, Inc.

Cinnaminson, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

AIRBORNE ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

National Voluntary
Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Mr. Stephen Siegel, CIH
Phone: 800-220-3675 Fax: 856-786-5973
E-Mail: ssiegel@emsl.com
URL: http://www.emsl.com

AIRBORNE ASBESTOS FIBER ANALYSIS (TEM) **NVLAP LAB CODE 101048-0**

NVLAP Code	*Designation / Description*
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

2012-07-01 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

NVLAP-01S (REV. 2005-05-19)

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-0

EMSL Analytical, Inc.

Cinnaminson, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2012-07-01 through 2013-06-30

Effective dates

DEPARTMENT OF COMMERCE ★ UNITED STATES OF AMERICA ★

For the National Institute of Standards and Technology

National Voluntary
Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Mr. Stephen Siegel, CIH
Phone: 800-220-3675 Fax: 856-786-5973
E-Mail: ssiegel@emsl.com
URL: http://www.emsl.com

BULK ASBESTOS FIBER ANALYSIS (PLM) **NVLAP LAB CODE 101048-0**

NVLAP Code	*Designation / Description*
18/A01	EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

NVLAP-01S (REV. 2005-05-19)

United States Department of Commerce
National Institute of Standards and Technology

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-10

EMSL Analytical, Inc.

Carle Place, NY

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

AIRBORNE ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
528 Mineola Ave.
Carle Place, NY 11514
Michelle McGowan
Phone: 516-997-7251 Fax: 516-997-7528
E-Mail: ssiegel@emsl.com
URL: http://www.emsl.com

AIRBORNE ASBESTOS FIBER ANALYSIS (TEM) **NVLAP LAB CODE 101048-10**

NVLAP Code	*Designation / Description*
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-10

EMSL Analytical, Inc.

Carle Place, NY

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
528 Mineola Ave.
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Michelle McGowan
Phone: 516-997-7251 Fax: 516-997-7528
E-Mail: ssiegel@emsl.com
URL: http://www.emsl.com

BULK ASBESTOS FIBER ANALYSIS (PLM) **NVLAP LAB CODE 101048-10**

NVLAP Code	*Designation / Description*
18/A01	EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples

2012-07-01 through 2013-06-30

Effective dates

For the National Institute of Standards and Technology

NVLAP-01S (REV. 2005-05-19)

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

EMSL Analytical, Inc.

200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: 100194

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories in* the following:

LABORATORY ACCREDITATION PROGRAMS

✓	**INDUSTRIAL HYGIENE**	Accreditation Expires: 07/01/2014
✓	**ENVIRONMENTAL LEAD**	Accreditation Expires: 07/01/2014
✓	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: 07/01/2014
☐	**FOOD**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation.** Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2005 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached **Scope of Accreditation.** Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

S. D. Allen Iske, PhD, CIH, CSP
Chairperson, Analytical Accreditation Board

Cheryl O. Morton
Managing Director, AIHA Laboratory Accreditation Programs, LLC

Revision 12: 03/29/2012

Date Issued: 07/31/2012

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: **100194**
Issue Date: 07/31/2012

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or revocation. A complete listing of currently accredited Industrial Hygiene laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 02/01/1989

IHLAP Scope Category	Field of Testing (FoT)	Technology sub-type/ Detector	Published Reference Method/Title of In-house Method	Method Description or Analyte *(for internal methods only)*
Chromatography Core	Gas Chromatography	GC/ FID	NIOSH 1003	
			NIOSH 1005	
			NIOSH 1400	
			NIOSH 1500	
			NIOSH 1550	
			NIOSH 1603	
			NIOSH 2000	
		GC/ECD	NIOSH 5502	
			NIOSH 5503	
			NIOSH 5510	
			OSHA 1010	
		GC/NPD	NIOSH 2551	
	GC/MS		EPA TO-15	
	Gas Chromatography (Diffusive Samplers)		NIOSH 1501	
	Ion Chromatography (IC)		NIOSH 6004	
			NIOSH 6011	
			NIOSH 7903	
			OSHA ID-214	
			OSHA ID-215	
	Liquid Chromatography	HPLC/FL	NIOSH 5506	
		HPLC/UV	NIOSH 2016	

AIHA
Laboratory Accreditation Programs, LLC

IHLAP Scope Category	Field of Testing (FoT)	Technology sub-type/ Detector	Published Reference Method/Title of In-house Method	Method Description or Analyte *(for internal methods only)*
Spectrometry Core	Atomic Absorption	CVAA	NIOSH 6009	
			OSHA ID-145	SOP LM-015
			OSHA ID-145	SOP LM-013
		FAA	NIOSH 7082	
		GFAA	NIOSH 7105	
	Inductively-Coupled Plasma	ICP/MS	NIOSH 7300 Modified	
		ICP/AES	NIOSH 7300	
	X-ray Diffraction (XRD)		NIOSH 7500	
			OSHA ID-142	
	UV/VIS (Colorimetric)		NIOSH 6010	
Asbestos/Fiber Microscopy Core	Polarized Light Microscopy (PLM)		EPA 600/R-93/116	
	Phase Contrast Microscopy (PCM)		NIOSH 7400	
	Transmission Electron Microscopy (TEM)		EPA AHERA - 40 CFR Part 763	
			NIOSH 7402	
Miscellaneous Core	Gravimetric		NIOSH 0500	
			NIOSH 0600	
			NIOSH 5524	
	Thermo-optical Analysis (TOA)		NIOSH 5040	

The laboratory participates in the following AIHA-LAP, LLC-approved proficiency testing programs:

- ✓ AIHA-PAT Programs, LLC IHPAT Metals
- ✓ AIHA-PAT Programs, LLC IHPAT Organic Solvents
- ✓ AIHA-PAT Programs, LLC IHPAT Silica
- ✓ AIHA-PAT Programs, LLC IHPAT Diffusive Sampler (3M)
- ❑ AIHA-PAT Programs, LLC IHPAT Diffusive Sampler (SKC)
- ❑ AIHA-PAT Programs, LLC IHPAT Diffusive Sampler (AT)
- ✓ AIHA-PAT Programs, LLC IHPAT Asbestos
- ❑ AIHA-PAT Programs, LLC Bulk Asbestos (BAPAT)
- ❑ AIHA-PAT Programs, LLC Beryllium (BePAT)
- ✓ HSE Workplace Analytical Scheme for Proficiency (WASP) (Formaldehyde)
- ❑ HSE Workplace Analytical Scheme for Proficiency (WASP) (Thermal Desorption Tubes)
- ❑ Pharmaceutical Round Robin
- ❑ Compressed/Breathing Air Round Robin
- ✓ National Voluntary Laboratory Accreditation Program (NVLAP - determined at the time of site assessment)
- ❑ New York State Department of Health (NYS DOH – PCM and TEM)
- ✓ ERA Air and Emissions standards for indoor air quality
- ❑ Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung (IFA, formerly BGIA)
- ❑ Institut de Recherche Robert-Sauvé en Santé et en Sécurité du Travail (IRSST)

CDPH
Health

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

EMSL Analytical Inc.

San Leandro

2235 Polvorosa Avenue, Suite 230

San Leandro, CA 94577

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **1620**

Expiration Date: **09/30/2013**

Effective Date: **10/01/2011**

Richmond, California
subject to forfeiture or revocation

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

EMSL Analytical Inc.
San Leandro
2235 Polvorosa Avenue, Suite 230
San Leandro, CA 94577
Phone: (510) 895-3675

Certificate No.: 1620
Renew Date: 9/30/2011

Field of Testing: 103 - Toxic Chemical Elements of Drinking Water

103.300	001	Asbestos	EPA 100.1
103.301	001	Asbestos	EPA 100.2

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.130	001	Lead	EPA 7420

Field of Testing: 121 - Bulk Asbestos Analysis of Hazardous Waste

121.010	001	Bulk Asbestos	EPA 600/M4-82-020

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

EMSL Analytical Inc.

200 Route 130 North

Cinnaminson, NJ 08077

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2492**

Expiration Date: **12/31/2013**

Effective Date: **01/01/2012**

Richmond, California
subject to forfeiture or revocation

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

State of California—Health and Human Services Agency
California Department of Public Health

RON CHAPMAN, MD, MPH
Director & State Health Officer

EDMUND G. BROWN JR.
Governor

March 27, 2012

Stephen Siegel
EMSL Analytical Inc.
200 Route 130 North
Cinnaminson, NJ 08077

Dear Stephen Siegel: Certificate No. 2492

This is to advise you that the laboratory named above has been certified as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, *et seq.*

The Fields of Testing for which this laboratory has been certified are indicated on the enclosed "Fields of Testing." The certificate shall remain in effect until **December 31, 2013** unless it is revoked. This certificate is subject to an annual fee as prescribed by HSC 100860.1(a).

The application for renewal of this certificate must be received before the expiration date of this certificate to remain in force according to the HSC 100845(a).

Any changes in laboratory location or structural alterations, which may affect adversely the quality of analysis in the Fields of Testing for which this laboratory has been granted a certificate, require prior notification. Notification is also required for changes in ownership or laboratory director within 30 days after the change (HSC, Section 100845(b) and (d)).

Your continued cooperation with the above requirements is essential for maintaining the high quality of the data produced by environmental laboratories certified by the State of California.

If you have any questions, please contact Bill Walker at (818) 551-2012.

Sincerely,

Fred Chaske for

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

Enclosure

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

EMSL Analytical Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Phone: (800) 220-3675

Certificate No.: 2492
Renew Date: 12/31/2013

Field of Testing: 103 - Toxic Chemical Elements of Drinking Water

103.300	001	Asbestos	EPA 100.1
103.301	001	Asbestos	EPA 100.2

Field of Testing: 121 - Bulk Asbestos Analysis of Hazardous Waste

121.010	001	Bulk Asbestos	EPA 600/M4-82-020

As of 4/4/2012 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

CALIFORNIA STATE

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM BRANCH

CERTIFICATE OF ENVIRONMENTAL ACCREDITATION

Is hereby granted to

EMSL ANALYTICAL, INC.

208 STONEHINGE LANE

CARLE PLACE, NY 11514

Scope of the certificate is limited to the
"Fields of Testing"
which accompany this Certificate.

Continued accredited status depends on successful completion of on-site, proficiency testing studies, and payment of applicable fees.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No.: **2339**

Expiration Date: **12/31/2012**

Effective Date: **01/01/2011**

Richmond, California
subject to forfeiture or revocation

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

RON CHAPMAN, MD, MPH
Director & State Health Officer

State of California—Health and Human Services Agency

California Department of Public Health

EDMUND G. BROWN JR.
Governor

January 27, 2012

Michele McGowan
EMSL Analytical Inc.
528 Mineola Ave.
Carle Place, NY 11514

Dear Michele McGowan:

Certificate No. 2339

This is to advise you that the laboratory named above has been certified as an environmental testing laboratory pursuant to the provisions of the Health and Safety Code (HSC), Division 101, Part 1, Chapter 4, Section 100825, *et seq.*

The Fields of Testing for which this laboratory has been certified are indicated on the enclosed "Fields of Testing." The certificate shall remain in effect until **December 31, 2012** unless it is revoked. This certificate is subject to an annual fee as prescribed by HSC 100860.1(a).

The application for renewal of this certificate must be received before the expiration date of this certificate to remain in force according to the HSC 100845(a).

Any changes in laboratory location or structural alterations, which may affect adversely the quality of analysis in the Fields of Testing for which this laboratory has been granted a certificate, require prior notification. Notification is also required for changes in ownership or laboratory director within 30 days after the change (HSC, Section 100845(b) and (d)).

Your continued cooperation with the above requirements is essential for maintaining the high quality of the data produced by environmental laboratories certified by the State of California.

If you have any questions, please contact Bill Walker at (818) 551-2012.

Sincerely,

Fred Chesher
for

George C. Kulasingam, Ph.D., Chief
Environmental Laboratory Accreditation Program Branch

Enclosure

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
Accredited Fields of Testing

EMSL Analytical Inc.
528 Mineola Ave.
Carle Place, NY 11514
Phone: (516) 997-7251

Certificate No.: 2339
Renew Date: 12/31/2012

Field of Testing: 103 - Toxic Chemical Elements of Drinking Water

103.301	001	Asbestos	EPA 100.2

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.370	010	Lead	SM3111B

Field of Testing: 114 - Inorganic Chemistry of Hazardous Waste

114.130	001	Lead	EPA 7420

Field of Testing: 115 - Extraction Test of Hazardous Waste

115.021	001	TCLP Inorganics	EPA 1311
115.030	001	Waste Extraction Test (WET)	CCR Chapter11, Article 5, Appendix II

Field of Testing: 121 - Bulk Asbestos Analysis of Hazardous Waste

121.010	001	Bulk Asbestos	EPA 600/M4-82-020

As of 1/27/2012 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

8. Customer Correspondence

McDaniel, Debrah

From: Samantha Caruthers-Knight [Samantha.Caruthers-Knight@errg.com]
Sent: Friday, October 26, 2012 3:11 PM
To: Denton, Robyn
Cc: Caitlin Gorman
Subject: Sample Prep

Robyn,

Per our phone conversation, please analyze the overloaded samples above 25% via the direct method, with a data flag. If you determine that the dust particles are too large and are obscuring the fibers, please let me know.

Please also hold all samples until we release them. This project has the potential to require going back to the original samples if there are questions about the data. The same is true for the last project, Phillips Mine can you check if those samples are still available and if they are can you please hold them until we release them?

Thanks,
Samantha

Samantha Caruthers-Knight
Assistant Project Geologist
Engineering/Remediation Resources Group, Inc

115 Sansome St, Suite 200
San Francisco CA, 94108
samantha.knight@errg.com

Main (925) 969-0750
Direct (415) 848-7100
Cell (510) 851-3279

McDaniel, Debrah

From: Samantha Caruthers-Knight [Samantha.Caruthers-Knight@errg.com]
Sent: Thursday, October 25, 2012 4:13 PM
To: Denton, Robyn
Cc: Cahill, Ed; Caitlin Gorman
Subject: RE: Teleconference

I believe that's 2 pm here, and yes we will be available.

From: Denton, Robyn [mailto:rdenton@EMSL.com]
Sent: Thursday, October 25, 2012 1:07 PM
To: Samantha Caruthers-Knight
Cc: Cahill, Ed
Subject: Teleconference

Hi Samantha,

Are you and your colleague available for a teleconference at 5pm EST?

Conference Call in number is:

1-800-550-6167
Code: 9738699

Thanks,

Robyn Denton | *Laboratory Manager*
EMSL Analytical, Inc. | 200 Route 130 North | Cinnaminson, NJ 08077
Phone: 856-303-2556 | Fax: 856-786-5974 | Toll Free: 800-220-3675
Lab Hours: Mon-Friday 7AM-10PM, Saturday 8AM-5PM, Sunday On-Call

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McDaniel, Debrah

From: Samantha Caruthers-Knight [Samantha.Caruthers-Knight@errg.com]
Sent: Wednesday, October 24, 2012 6:58 PM
To: Denton, Robyn
Subject: RE: Results for your TEM ISO project

Thanks Robyn. Can you also send the name of the sample with the highest result so far and the number of fibers detected or str/cc?

From: Denton, Robyn [mailto:rdenton@EMSL.com]
Sent: Wednesday, October 24, 2012 2:37 PM
To: Samantha Caruthers-Knight
Cc: Cahill, Ed
Subject: Results for your TEM ISO project

Samantha,

Per our conversation earlier today, here is a list of the samples deemed overloaded with particulate and were unable to be analyzed.

If you wish to have the overloaded samples prepared indirectly, we will run the samples here from my location. I have asked our San Leandro lab to Overnight all materials from this project to me. In speaking with the lab , the majority of the samples were over 25% for particulate loading. Once you decide how you wish to proceed with these samples, I can update you as to when the indirect data will be reported.

From this point out, I will be the point of contact for this project going forward. Should you have any questions, please don't hesitate to contact me. My contact information is below.

Robyn Denton | *Laboratory Manager*
EMSL Analytical, Inc. | 200 Route 130 North | Cinnaminson, NJ 08077
Phone: 856-303-2556 | Fax: 856-786-5974 | Toll Free: 800-220-3675
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McDaniel, Debrah

From: Caitlin Gorman [caitlin.gorman@errg.com]
Sent: Tuesday, October 30, 2012 7:34 PM
To: Samantha Caruthers-Knight; Denton, Robyn
Cc: Cahill, Ed
Subject: RE: Preliminary Data

We would also like to run the remaining samples. Sam should be calling you today to discuss.
-Caitlin

From: Samantha Caruthers-Knight
Sent: Thursday, October 25, 2012 5:26 PM
To: Denton, Robyn; Caitlin Gorman
Cc: Cahill, Ed
Subject: RE: Preliminary Data

Thanks Robyn, Can you run the ten samples with 25% or less overloading via the standard ISO 10312 method and when do you expect we could see the results of that analysis? We are still working out what to do about the remaining 12.

Thanks
Samantha

From: Denton, Robyn [mailto:rdenton@EMSL.com]
Sent: Thursday, October 25, 2012 4:32 PM
To: Samantha Caruthers-Knight; Caitlin Gorman
Cc: Cahill, Ed
Subject: Preliminary Data

Samantha and Caitlin,

Attached are the preliminary data we discussed on today's teleconference. This table includes the percent of particulate on the overloaded samples.

I hope this helps.

Robyn Denton | *Laboratory Manager*
EMSL Analytical, Inc. | 200 Route 130 North | Cinnaminson, NJ 08077
Phone: 856-303-2556 | Fax: 856-786-5974 | Toll Free: 800-220-3675
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attachments. Thank you."

McDaniel, Debrah

From: Caitlin Gorman [caitlin.gorman@errg.com]
Sent: Friday, November 02, 2012 6:45 PM
To: Denton, Robyn; Samantha Caruthers-Knight
Cc: Cahill, Ed
Subject: RE: ISO Report

Thanks

From: Denton, Robyn [mailto:rdenton@EMSL.com]
Sent: Friday, November 02, 2012 3:21 PM
To: Caitlin Gorman; Samantha Caruthers-Knight
Cc: Cahill, Ed
Subject: RE: ISO Report

Samantha,

Thanks for taking the time to review the project status with Ed and I today.

Per our discussion, we now have 2 analysts dedicated to this project and are preparing to bring our Long Island Laboratory (CA accredited lab) onto the project as well.

Each analyst is averaging one sample a day due to the heavy particulate loading. In addition to the general particulate we are finding asbestos fibers which need to be analyzed one at a time as we encounter them. In addition as we discussed, we are seeing some non- regulated amphiboles as well. When we encounter those we are noting their presence with sample comments.

Going forward we anticipate being able to report each sample as analysis is completed. As of today 5 out of 22 samples have been analyzed. The reports will be validated and sent out to you on Monday.

Robyn Denton | *Laboratory Manager*
EMSL Analytical, Inc. | 200 Route 130 North | Cinnaminson, NJ 08077
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From: Caitlin Gorman [mailto:caitlin.gorman@errg.com]
Sent: Thursday, November 01, 2012 7:09 PM
To: Samantha Caruthers-Knight; Denton, Robyn
Cc: Cahill, Ed
Subject: RE: ISO Report

Is there just one person working on our samples? This seems like a really long time to get the results (especially given how long we've already waited for the others).
We were expecting 2-week turn around times on our original samples – now we are looking at a 3-week TAT on these samples that really need to be expedited because our schedule has been severely impacted to the point where the client may not pay us full price for our report (since we won't be able to deliver it on time).
Please evaluate whether you can add personnel to get us the data sooner.
Also, is there is a way to give us preliminary results (unvalidated) sooner?

From: Samantha Caruthers-Knight
Sent: Thursday, November 01, 2012 2:24 PM
To: Denton, Robyn; Caitlin Gorman
Cc: Cahill, Ed
Subject: RE: ISO Report

After speaking with the risk assessor, it sounds like capping our fiber count will introduce a level of uncertainty into the data that may ultimately call our conclusions into question, which we don't want to do. Please analyze the samples using the same protocol that was used for the other samples.

Thanks

Samantha

From: Denton, Robyn [mailto:rdenton@EMSL.com]
Sent: Wednesday, October 31, 2012 3:23 PM
To: Denton, Robyn; Samantha Caruthers-Knight; Caitlin Gorman
Cc: Cahill, Ed
Subject: ISO Report

Samantha and Caitlin,

Attached is the final ISO report and Excel EDD for all the samples that were analyzed directly at San Leandro.

Please note that the 22 that were originally overloaded are not reported here. In effort to keep data flowing to you, reports will be issued as the analysis is completed.
We are estimating 3 weeks for completion on the original 22 samples. I have discussed with Samantha about changing the structure stopping rules on these samples, which may be a way to speed up analysis.

Thanks,

Robyn Denton | *Laboratory Manager*
EMSL Analytical, Inc. | 200 Route 130 North | Cinnaminson, NJ 08077
Phone: 856-303-2556 | Fax: 856-786-5974 | Toll Free: 800-220-3675
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McDaniel, Debrah

From: Samantha Caruthers-Knight [Samantha.Caruthers-Knight@errg.com]
Sent: Friday, November 16, 2012 3:16 PM
To: Denton, Robyn
Subject: Re: **Results Status Update**
Attachments: image001.jpg; image010.jpg; image011.jpg; image012.jpg; image013.jpg

Thanks Robyn, I look forward to seeing he results.

On Nov 16, 2012, at 11:52 AM, "Denton, Robyn" <rdenton@EMSL.com> wrote:

Hi Samantha,

I just wanted to update you that by the end of today, we should have completed analysis on the remaining 22 samples.
I am anticipating the final reporting of all 22 samples by Monday.

Regards,
<image001.jpg> **Robyn Denton** | *Laboratory Manager*
EMSL Analytical, Inc. | 200 Route 130 North | Cinnaminson, NJ 08077
Phone: 856-303-2556 | Fax: 856-786-5974 | Toll Free: 800-220-3675
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Appendix C. Technical Memorandum Regarding Preliminary Evaluation of Risk from Inhalation of Asbestos

ERRG
Engineering/Remediation Resources Group, Inc.
115 Sansome St., Suite 200
San Francisco, CA 94104
P: 415.395.9974
F: 415.395.9983
www.errg.com

February 15, 2013 Ref.: 2011-119

Mr. Curtis Cross
Six Rivers National Forest
Forest Service Region 5
1330 Bayshore Way
Eureka, CA 95501

Technical Memorandum
Preliminary Evaluation of Risk from Inhalation of Asbestos
at the Horse Mountain Mine and Mill Site, Six Rivers National Forest

Dear Mr. Cross:

Engineering/Remediation Resources Group, Inc. (ERRG) has prepared this technical memorandum in support of the ongoing Engineering Evaluation/Cost Analysis (EE/CA) for the Horse Mountain Mine and Mill Site in the Six Rivers National Forest in Humboldt County, California. The EE/CA is being conducted under the U.S. Department of Agriculture (USDA) Forest Service (Forest Service) Regional Environmental Response Action Contract (AG-91S8-C06-0056) and includes a streamlined risk evaluation (SRE) to evaluate risk from site contaminants (metals and chrysotile asbestos) to recreational users of the site.

This technical memorandum presents the preliminary findings of the SRE for asbestos only. The in-progress EE/CA will include a complete SRE for all site contaminants and present removal action alternatives, in accordance with appropriate U.S. Environmental Protection Agency (EPA) guidance (EPA, 1993 and 2000, see Enclosure 1 for a list of all reference cited in this technical memorandum).

The purpose of the SRE is to (1) to evaluate potential risks from asbestos inhalation at areas disturbed by mining activities and (2) to compare SRE results from the site to SRE results from a background area not disturbed by mining activities. To accomplish this goal, onsite and offsite activity-based air samples were collected representing activities that are likely to occur at the site.

1. Site Background

The Horse Mountain Mine Site is an inactive copper mine within the Six Rivers National Forest, located approximately 7 miles southwest of Willow Creek, in Humboldt County, California (Figure 1 in Enclosure 2). The site is accessed via a paved road (Titlow Hill Road), behind a locked gate. The site includes roads, adits, and mine waste piles located along the banks of an unnamed ephemeral creek that discharges into Horse Mountain Creek, a tributary to Willow Creek and the Smith River (Figure 2 in Enclosure 2). The mine features consist of an open pit area, two primary adits, two collection ponds, various concrete foundations for operations and residence buildings that are no longer present, and associated mine waste piles (ERRG, 2012).

Previous investigations at the site indicated metals and chrysotile asbestos are present in mine waste materials throughout the site at elevated concentrations (Weston Solutions, Inc. [Weston], 2007). During the 2007 Preliminary Assessment/Site Inspection, three waste samples were collected and analyzed for chrysotile asbestos. One sample was collected from each of three main site areas of concern: the Open Pit Area, the Adit/Pond Area, and the Mill Site. Chrysotile asbestos was reported at 31.3 percent chrysotile in the sample from the Open Pit Area, at less than 1 percent chrysotile in the sample from the Adit/Pond Area, and at 5.4 percent chrysotile in the sample from the Mill Site (Weston, 2007). Figure 2 in Enclosure 2 presents the sample locations.

This SRE focuses on the following human receptors that may be exposed to asbestos at the site:

- Mountain bikers and hikers
- All-terrain vehicle (ATVs) riders
- People using the site for target shooting

2. Regulatory Framework for Asbestos Investigations

Asbestos is a known carcinogen and respiratory hazard; as a result, it has the potential to pose a serious risk to site visitors and the environment. Mining and milling at the site may have increased the potential for asbestos present in native rock at the site to become airborne. Once airborne, the likelihood that site visitors could be exposed to asbestos fibers through the inhalation pathway increases. National Emission Standards for Hazardous Air Pollutants defines "friable asbestos material" as any material containing more than 1 percent asbestos using the method specified in Title 40 Code of Federal Regulations, Part 763, Subpart E, Appendix E, Section (§) 1, "Polarized Light Microscopy" (PLM)[1]. Additionally, the California Air Resources Board's Asbestos Airborne Toxics Control Measure (Title 17 California Code of Regulations § 93106)[2] indicates that "restricted material" includes ultramafic rock and any material that has been tested and found to have an asbestos content of 0.25 percent or greater, as measured by PLM. Currently, no available methods can reliably predict the concentration of asbestos in air based on concentrations in source materials (i.e., soil, waste material, or building materials) (EPA, 2008). As indicated by EPA (2008), disturbance of soil or other bulk materials with asbestos concentrations less than the level of detection may still result in potentially hazardous airborne exposures. EPA considers the collection of activity-based air samples, which evaluate airborne asbestos concentrations associated with specific activities, to be the most appropriate method for estimating risk from asbestos. Results of ongoing EPA investigations have indicated that airborne exposures associated with the disturbance of contaminated soil depend upon a number of factors such as environmental conditions, soil composition, releasability and friability of the asbestos materials present, and the nature of the disturbance activities (EPA, 2007 and 2008). As a result, collection of activity-based samples is required at asbestos-contaminated sites to evaluate fully the potential exposure of recreational visitors to asbestos via the inhalation pathway. While the standards for evaluating asbestos in bulk materials are based on use of PLM technology, the more sensitive transmission electron microscopy (TEM) method is required to evaluate air samples.

3. Asbestos Air Sampling

Activity-based air samples were collected to simulate potential airborne concentrations of asbestos during activities that are likely to occur at the Horse Mountain Mine Site. Activity-based air samples were collected and evaluated for asbestos in accordance with EPA's Standard Operating Procedure (SOP) 2084

[1] http://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol31/pdf/CFR-2011-title40-vol31-part763.pdf

[2] http://www.arb.ca.gov/toxics/atcm/asbeatcm.htm

(EPA, 2007) and the EE/CA Work Plan (Engineering/Remediation Resources Group, Inc. [ERRG], 2012) for the following site-specific recreational scenarios:

- Mountain biking
- Hiking (modified jogger scenario)
- ATV riding
- Recreational shooting

In accordance with EPA SOP 2084 and the EE/CA Work Plan (ERRG, 2012), activity-based samples were collected from each of three areas at the site (Open Pit, Adit/Pond, and Mill Site) and a background area for each activity. Because recreational activities are often conducted in groups of two or more, where one person follows another, the follower may be exposed to dust generated by the leader. To evaluate both scenarios, two field samplers, one leader and one follower, conducted each activity. Each sampler also collected two samples, one with the intake positioned to represent the breathing zone of an adult and the second with an intake positioned to represent a child's breathing zone. Four samples were collected for each activity in each area. In addition, several duplicate samples were collected for quality control purposes.

Ambient air samples were also collected concurrently with the activity-based samples to evaluate the ambient air quality each day that samples were collected. The ambient sampling stations were placed upwind and downwind of the work area and far enough away from the active work zone where activity-based air samples were being collected to ensure that the upwind sample represented a true undisturbed ambient sample.

The following equipment was used to collect the activity-based and ambient air samples:

- Activity-based air: a personal air sample pump with a preloaded asbestos filter cassette.
- Ambient air: a stationary pump with a preloaded asbestos filter cassette that was fixed to an immobile object such as a tree, signpost, or stake.

Prior to the sampling event, historical weather patterns were evaluated to identify the most appropriate time of year to collect the samples. Table 1 in Enclosure 3 presents the monthly average maximum/minimum temperature and rainfall data collected at the Willow Creek weather station (the closest station to the site). The purpose of this evaluation was to ensure that samples were collected during dry conditions, when dust is most likely to become airborne. July is historically the driest month, so samples were collected between July and the start of the rainy season, as late in the year as possible, to represent the driest site conditions. During the sampling event, the soil conditions in each sampling area were evaluated using the USDA guidance for estimating soil moisture by feel and appearance (USDA, 1998 in Enclosure 1). All soil evaluated was classified as dry and loose, falling in the lowest moisture category (0 to 25 percent). Soil across the site varied in grain size and degree of compaction but was generally consistent in composition. Most of the soil across the site and at the background area consisted of greenish-gray gravel with silt, derived from the local serpentinite bedrock. Photographs of surface soil conditions in each area are presented in Enclosure 4.

3.1. Onsite Sampling

As stated in Section 1, activity-based air samples were collected in three site areas (the Open Pit, Adit/Pond, and Mill Site). Figures 3, 4, and 5 in Enclosure 2 show the sampling routes and areas, as well as the ambient air monitoring locations. Within each of the areas, three or four activities were conducted

as described in Section 3[3]. Soil across the site varied in grain size and level of compaction but was generally very consistent in composition. Soil consisted primarily of fragments of the green/gray serpentinite bedrock visible throughout site. Soil, waste, and road materials had a slightly greenish-gray appearance.

3.2 Background Sampling

To evaluate background conditions, activity-based and ambient air samples were collected in a background area not impacted by mining activity at the site. The background area, selected in consultation with the Forest Service, is located at the top of Horse Mountain, along a ridgeline (see Figure 6 in Enclosure 2). The area was selected because it represents similar geology to the site and is an area where activity-based samples could be collected (i.e., it is an open space). The background area is currently being used as a communications tower hub and includes several buildings and communication towers.

The soil and road base materials in the background area were generally very similar to the materials at the site (i.e., poorly vegetated, green/gray angular gravel and gray soil). The area just southwest of the communication towers (approximately 20,000 square feet) appeared to have been recently graded and the soil was brown rather than green/gray, which may indicate that the area includes imported fill material rather than native soil. Sampling routes in the background area were selected to include both the possible fill (brown) area and the other (green/gray) areas (abandoned gravel roads) where native material appeared to be consistent with materials identified at the site. Figure 6 in Enclosure 2 shows the sampling routes and areas.

4. Asbestos Analytical Methodology

Activity-based and ambient air samples were shipped to an offsite California-certified laboratory for TEM analysis of asbestos to distinguish between asbestos fibers and non-asbestos fibers in accordance with the EE/CA Work Plan (ERRG, 2012). Consistent with EPA's recommendations for activity-based sampling (EPA, 2008), the TEM analysis was performed in accordance with the International Organization for Standardization (ISO) Method 10312 (ISO, 1995). Asbestos concentrations were reported in terms of phase contrast microscopy equivalent (PCME) fibers, which are defined as fibers greater than 5 microns (µm) long, with a width between 0.25 and 3.0 µm and a length-to-width ratio greater than 3:1. Fibers of this size have been linked most closely with asbestos-related diseases (EPA, 2008; World Health Organization, 1986) and form the basis for EPA's inhalation toxicity value for asbestos.

TEM analysis is conducted by visual analysis of the samples, as described in EPA SOP 2084 (EPA, 2007). Laboratory personnel use TEM to visually observe each 385-square-millimeter (mm^2) filter and count the fibers. Because an extreme magnification is used[4], however, analysis of the entire 385-mm^2 filter is impractical. As a result, a randomized selection of 0.013-mm^2 grid openings is analyzed to represent the whole sample. Following sample preparation and equipment calibration, each grid opening in a given sample is visually observed systematically under magnification for suspect asbestos fibers and fiber structures. The asbestos concentration in the sample is then extrapolated from the number of observed structures based on the number of grid openings evaluated, the volume of the air sample, and the size of the air filter evaluated.

[3] Recreational shooting was not conducted at the Adit/Pond Area because no evidence of shooting activities was found in the area.

[4] The TEM Method specifies magnification between 300 X and 1,000,000 X (ISO, 1995)

5. Asbestos Sampling Results

In total, 75 samples, including activity-based air samples, background samples, ambient air samples, and duplicate samples, were collected. Sixty-two of the 75 samples were found to contain measurable concentrations of asbestos. Asbestos fibers were detected in 43 of the 50 activity-based air samples, in 14 of the 16 background samples, and in 5 of the 9 ambient air samples. Chrysotile was the most commonly detected fiber type. Thirty-eight of the 62 samples that contained asbestos fibers contained 100 percent chrysotile. Twenty–four samples contained a mix of chrysotile and amphibole asbestos. The percentage of chrysotile in the samples ranged from 39.2 percent to 88.7 percent, with an average of 67.2 percent. Asbestos concentrations and percentages of chrysotile for all samples collected at the site are presented in Table 2 in Enclosure 3.

6. SRE from Exposure to Asbestos

Activity-based and ambient air samples were collected at the Horse Mountain Mine and Mill Site to evaluate the potential cancer risk to site visitors for various recreational activities that might occur on the site. Cancer risk is the estimated probability that a person will develop cancer from exposure to site contaminants and is generally expressed as an upper-bound probability. For example, a risk of 1 in 10,000[5] indicates that for every 10,000 people, one additional cancer case may occur as a result of exposure to asbestos at the site. A risk of 1 in 1,000,000 indicates that for every 1,000,000 people, one additional cancer case may occur as a result of exposure to asbestos at the site. This EE/CA adopted a conservative approach and used the cancer risk of 1×10^{-6} (or 1E-06), which meets the most conservative end of the risk management range established by EPA (1×10^{-4} to 1×10^{-6} [or 1E-04 to 1E-06], EPA 1993).

Following tabulation of results, exposure parameters for each receptor were established to calculate the excess lifetime cancer risk (ELCR) for each activity in each area.

The basic equation for calculating the ELCR from exposure to asbestos is:

$$Risk\ (ELCR) = EPC \times TWF \times IUR \qquad \text{(Equation 5-1)}$$

where:

ELCR	=	excess lifetime cancer risk, which is the risk of developing cancer as a result of site-related exposure
EPC	=	exposure point concentration, the concentration of asbestos in air (strands per cubic centimeter [str/cc]) for the specific activity being assessed
TWF	=	time weighting factor for the scenario being assessed
IUR	=	inhalation unit risk $(str/cc)^{-1}$, corresponding to the age at first exposure and exposure duration for the exposure scenario

EPA's "Framework for Investigating Asbestos-Contaminated Superfund Sites" recommends procedures to calculate TWF for various exposure scenarios and IUR for less-than-lifetime exposure scenarios (EPA, 2008). The TWF is calculated as the percentage of time a receptor would spend on site within a year and is represented by the following equation:

[5] Cancer risk estimates are typically expressed in scientific notation. For example, a risk of 1 in 10,000 is expressed as 1×10^{-4} (or 1E-04). Similarly, a risk of 1 in 1,000,000 is expressed as 1×10^{-6} (1E-06).

$$TWF = (ET \times EF) / (24\ hours/day \times 365\ days/year) \quad \text{(Equation 5-2)}$$

where:

ET	=	exposure time, which is the number of hours exposed per day
EF	=	exposure frequency, which is the number of days exposed per year

IUR values were derived from Table 2 of EPA, 2008, based upon the assumed age at which exposure begins and the duration of exposure.

Table 3 in Enclosure 3 presents the exposure parameters for the various human receptors evaluated at the Horse Mountain Mine and Mill Site, which are also discussed below. The exposure parameters were based on observations of land use patterns at the site, professional judgment, and the following conservative assumptions. A discussion of uncertainties in the assumptions is presented after the SRE results in Section 5.4.

- Mountain Biker: It is assumed that the mountain biker uses the Horse Mountain Mine and Mill Site on a regular basis for mountain bike riding. It is assumed that the mountain biker visits the site 1 day per weekend for 9 months out of the year, for a total of 39 visits per year. The mountain biker is further assumed to use the site for a period of 3 hours per visit. The remainder of the year, it is assumed that the site is covered in snow with no potential for asbestos exposure. For the child mountain biker, it is assumed that exposure begins at 5 years of age, with an exposure duration of 10 years. For the adult mountain biker, it is assumed that exposure begins at 15 years of age, with an exposure duration of 30 years.
- Hiker: It is assumed that the hiker uses the Horse Mountain Mine and Mill Site on a regular basis for hiking. It is assumed that the hiker visits the site 1 day per weekend for 9 months out of the year, for a total of 39 visits per year. The hiker is further assumed to use the site for a period of 2 hours per event. The remainder of the year, it is assumed that the site is covered in snow with no potential for asbestos exposure. For the child hiker, it is assumed that exposure begins at 5 years of age, with an exposure duration of 10 years. For the adult hiker, it is assumed that exposure begins at 15 years of age, with an exposure duration of 30 years.
- ATV Rider: It is assumed that the ATV rider uses the Horse Mountain Mine and Mill Site on a regular basis for ATV riding. It is assumed that the ATV rider visits the site 1 day per weekend for 9 months out of the year, for a total of 39 visits per year. The ATV rider is further assumed to use the site for a period of 6 hours per event. The remainder of the year, it is assumed that the Site is covered in snow with no potential for asbestos exposure. For the child ATV rider, it is assumed that exposure begins at five years of age with an exposure duration of 10 years. ATV models are available for children as young as 6 years old. However, because children have varying sizes and maturity levels, it is plausible that a child as young as 5 years old may use the site for ATV riding under adult supervision. For the adult ATV rider, it is assumed that exposure begins at 15 years of age with an exposure duration of 30 years.
- Recreational Shooter: It is assumed that the recreational shooter is a local resident using the Horse Mountain Mine Site on a regular basis for target practice. It is assumed that the recreational shooter visits the site 1 hour per day, 3 days per week for 9 months out of the year, for a total of 117 visits per year. The remainder of the year, it is assumed that the site is covered in snow with no potential for asbestos exposure. For the child recreational shooter, it is assumed that exposure begins at 5 years of age, with an exposure duration of 10 years. Rifle models are specifically available for young children, so it is plausible that a child as young as 5 years old would use the site for shooting under an adult's supervision. For the adult recreational shooter, it is assumed that exposure begins at 15 years of age, with an exposure duration of 30 years.

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6.1. SRE Results for Asbestos

Table 4 in Enclosure 3 presents the results of the activity-based air samples for each of the four activities conducted at the Open Pit Area, Adit/Pond Area, and Mill Site. Table 5 in Enclosure 3 presents the results of the activity-based air samples in the background area. Tables 4 and 5 present the number of PCME fibers visible in each sample, the associated analytical sensitivity, the individual results for each sample in units of str/cc, and the risk associated with each sample. Table 6 in Enclosure 3 presents the results of the stationary ambient air samples at each of the three areas, as well as the background area.

Table 7 in Enclosure 3 presents the calculated ELCR for each activity at each area of the Horse Mountain Mine Site. The results are compared to the risk management range outlined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Title 40 Code of Federal Regulations Part 300[6]). Consistent with the NCP, a cancer risk of 1E-06 is used as the point of departure for risk management decisions; ELCRs less than 1E-06 are generally considered acceptable and typically do not require action. Site-specific factors are typically considered at sites where the ELCR is between 1E-06 and 1E-04. For ELCRs exceeding the risk management range, action is generally required.

6.1.1. Site SRE results

- Mountain Biking: Asbestos in 1 sample exceeded the risk management range (2E-04) and was within the risk management range (between 3E-05 and 1E-04) in 11 samples and 1 duplicate.
- Hiking: Asbestos in nine samples and two duplicates was within the risk management range (between 1E-05 and 8E-05) and was less than the risk management range (less than 1E-06) in three samples.
- ATV Riding: Asbestos in eight samples and one duplicate exceeded the risk management range (between 2E-04 and 5E-04) and was within the risk management range (between 8E-05 and 1E-04) in four samples and one duplicate.
- Recreational Shooting: Asbestos in four samples and one duplicate was within the risk management range (between 2E-05 and 7E-05) and was less than the risk management range (less than 1E-06) in four samples.

6.1.2. Background SRE results

- Mountain Biking: Asbestos in two samples was within the risk management range (6E-05 and 7E-05) and was less than the risk management range (less than 1E-06) in two samples.
- Hiking: Asbestos in four samples was within the risk management range (between 9E-06 and 7E-05).
- ATV Riding: Asbestos in three samples exceeded the risk management range (between 2E-04 and 4E-04), and was within the risk management range (7E-05) in one sample.
- Recreational Shooting: Asbestos in four samples was within the risk management range (between 2E-05 and 4E-05).

[6] http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&tpl=/ecfrbrowse/Title40/40cfr300_main_02.tpl

6.1.3. Ambient Sampling Results

Results for the ambient air samples are not appropriate for use in estimating risks to individuals, but may be used to evaluate airborne concentrations of asbestos within areas where a given activity was conducted. Results of the ambient air samples are generally lower, in some cases up to an order of magnitude lower, than the results for the activity-based air samples. Asbestos was not detected in ambient air samples from the Open Pit Area. The highest concentrations of asbestos (0.0253 and 0.027 str/cc) were reported in ambient air samples from the Adit/Pond Area and the Mill Site, respectively. Asbestos was also detected in ambient air samples collected from the background area at a maximum concentration of 0.0107 str/cc.

6.2. Data Quality

Results of the TEM analysis are statistical. As noted in Section 4, the calculated asbestos concentration is extrapolated from a relatively small area, which is then applied to the entire sample. In some activity-based samples from the site, asbestos structures were observed but not in a quantifiable amount. In these instances, asbestos is assumed to be present at concentrations lower than the limit of detection. The analytical sensitivities developed in the EE/CA Work Plan (ERRG, 2012) were selected to ensure that data collected would be usable for risk assessment purposes. Because the sensitivity is a function of several factors, which may vary from sample to sample, the achieved analytical sensitivity varies slightly from sample to sample (Tables 4, 5, and 6 in Enclosure 3). The sensitivities for all samples met the minimum target sensitivities (0.004 str/cc for activity-based samples and 0.002 str/cc for ambient samples) identified in the EE/CA Work Plan (ERRG, 2012) and are considered usable.

Some samples collected during activities generating high amounts of dust became overloaded (i.e., particulate loading on the filter was greater than 25 percent). These sample results have the potential to be biased low, because other (non-asbestos) particulates may obscure fibers. These samples were analyzed using ISO 10312 and were flagged for potential for low bias. Despite the potential low bias, the SRE results for all overloaded samples exceeded or were within the risk management range. In addition, results of the activity-based samples (primarily mountain biking and ATV riding) that were not overloaded indicate that asbestos is present at concentrations that could present a health risk to current and future site visitors. For the purposes of identifying risk, the results of the overloaded samples are considered usable.

6.3. Preliminary SRE Conclusions for Asbestos

Results of the activity-based air samples demonstrate that asbestos fibers in soil and waste materials at the Horse Mountain Mine and Mill Site are being released into the breathing zone when certain outdoor activities are conducted. Activities at the site that disturb the most soil and generate the most dust result in the highest exposure risk to asbestos in air.

Results for activity-based air samples for activities in the background area do not differ significantly from the results for the corresponding activities conducted at the site. Eighteen percent of background ELCRs exceeded the risk management range compared with 20 percent of site ELCRs. Seventy percent of background ELCRs were within the risk management range compared with 64 percent of site ELCRs. Twelve percent of background ELCRs were lower than the risk management range compared with 16 percent of site ELCRs. ATV riding was the only activity where ELCRs consistently exceeded the risk management range. Only one ELCR for mountain biking exceeded the risk management range. ELCRs for hiking and recreational shooting did not exceed the risk management range either at the site or in the background area.

There is no clear distinction between ELCRs within the site (i.e., when comparing the three site areas). No area has clearly higher or lower risk than any other area. This conclusion is further supported by the ambient air sampling results, which do not show clear differences in concentrations of asbestos between the onsite and background areas. Sample results for the background area are neither higher nor lower than the site areas, but fall within the range of results collected at the site.

6.4. Uncertainty Analysis

The risk assessment process involves assumptions regarding land use patterns and exposure, and some level of uncertainty is associated with all risk assessments. The uncertainties associated with the SRE for the Horse Mountain Mine and Mill Site, and their possible impact on the risk calculations, are briefly described below.

- Consistent with industry standards for asbestos risk assessment, only fibers that meet the PCME size requirement were included in the evaluation. The actual risk may be higher or lower, depending upon the relative proportion of PCME fibers to the total number of asbestos structures.
- Receptors and exposure parameters evaluated in the risk assessment were based upon presumed land use patterns and professional judgment. Risks associated with other types of exposures not included in the analysis may be higher or lower than those evaluated in the risk assessment.
- Many factors affect the releasability of asbestos fibers from soil to air. Asbestos fibers in soil and waste materials at the Horse Mountain Mine Site may be primarily large particles, which may be broken down over time, increasing the fraction of fibers that exist as readily releasable fibers. This increase in releasable fibers may result in an increase of asbestos concentrations in air over time and thus increase the risk to future receptors.
- Activity-based samples were collected in September and were assumed to represent airborne asbestos conditions throughout the year. Late summer is typically the driest time of the year at the site, thus exposures from airborne asbestos evaluated in this SRE are assumed to represent the most conservative or worst-case scenario. Airborne asbestos concentrations during months that receive significant amounts of rain or snow are likely to be lower and the associated risk of exposure during these months is expected to be lower.
- Alternative assumptions regarding exposure durations have an effect on the risk calculations. To evaluate this effect at this site, a second risk screening was conducted that assumed receptors would only conduct recreational activities at the site for 4 months out of the year, rather than 9 months. The results of this alternative risk evaluation are presented in Enclosure 5. These results are not significantly different from the initial SRE results. The risks for adult mountain bikers at the Open Pit area (which previously exceeded the risk management range) fell to within the risk range. ATV riding generated the highest risk, exceeding the risk range at two of the areas (Adit/Pond and Mill Site), as well as the background area. For all other activities, no significant difference was observed between the two risk evaluations.

7. Conclusions

The results of the SRE of asbestos indicate that, while some risk is associated with asbestos at the site, no distinguishable difference in risk exists between the three site areas and the background area. As a result, a removal action to address asbestos at the site is not likely to reduce the risk of asbestos exposure to recreational users and is not recommended. Non-removal alternatives that reduce asbestos exposure of site visitors may be considered in the EE/CA. Further evaluation of metals contamination and removal alternatives that may also mitigate the potential for asbestos exposure will be included in the EE/CA.

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Please let us know if you have any comments or questions on the results of this evaluation.

Sincerely,

Caitlin Gorman
Project Manager

Encl.: 1 – References
2 – Figures 1, 2, 3, 4, 5, and 6
3 –Tables 1, 2, 3, 4, 5, 6, and 7
4 – Photographic Log
5 – Alternative SRE Table 1

Cc: Project File
Bradley Hall, ERRG
Samantha Caruthers-Knight, ERRG

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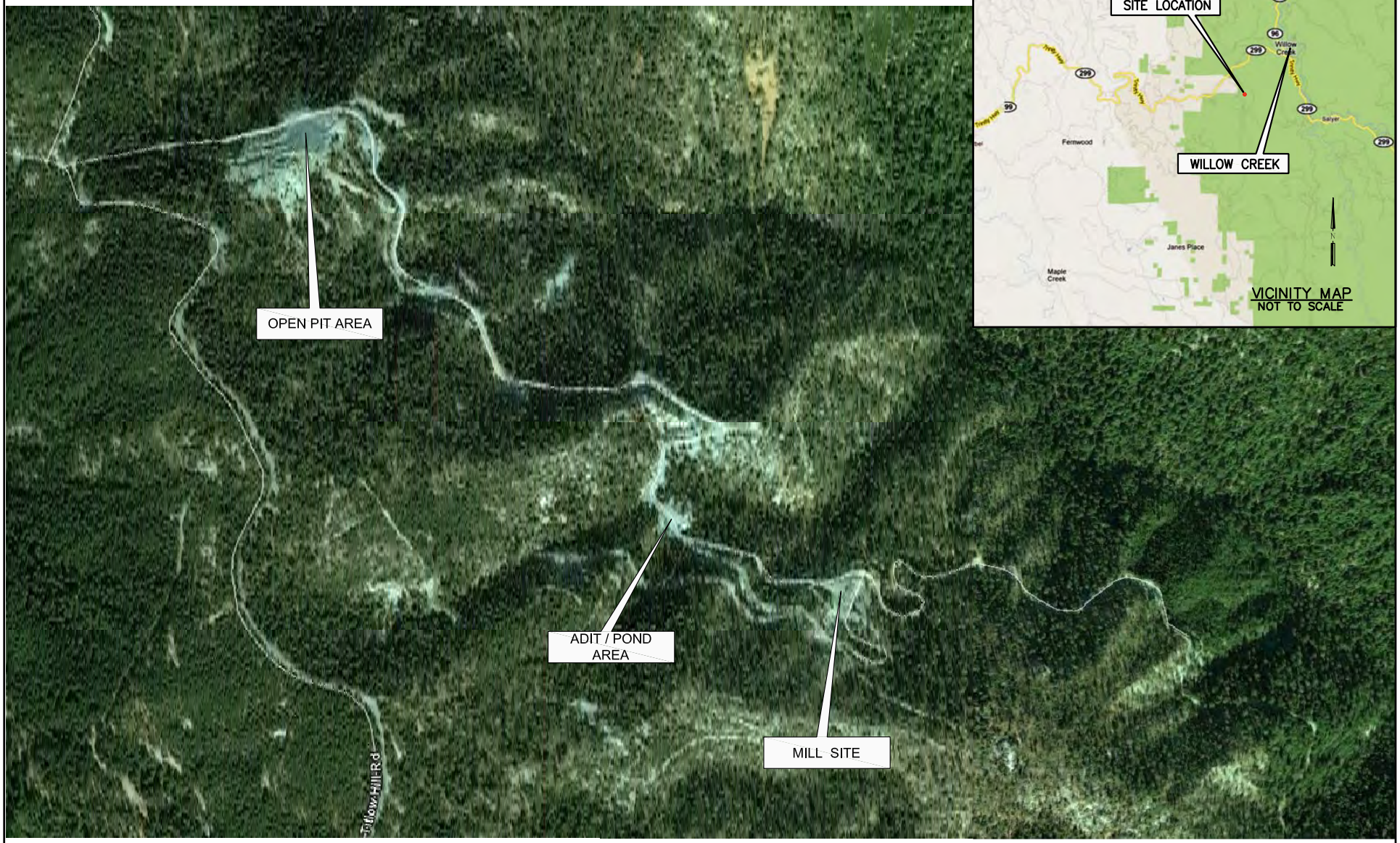
Enclosure 2. Figures



SOURCE: GOGGLE MAPS

N

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APPROXIMATE SCALE: 1"=500'

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(415) 395-9974

CLIENT: U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE

LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST

SITE LOCATION AND VICINITY MAP

DRAWN BY:	CHECKED BY:	PROJECT NO.	FIG NO.
SC 11/15/11	RWP 11/15/11	2011-119	1

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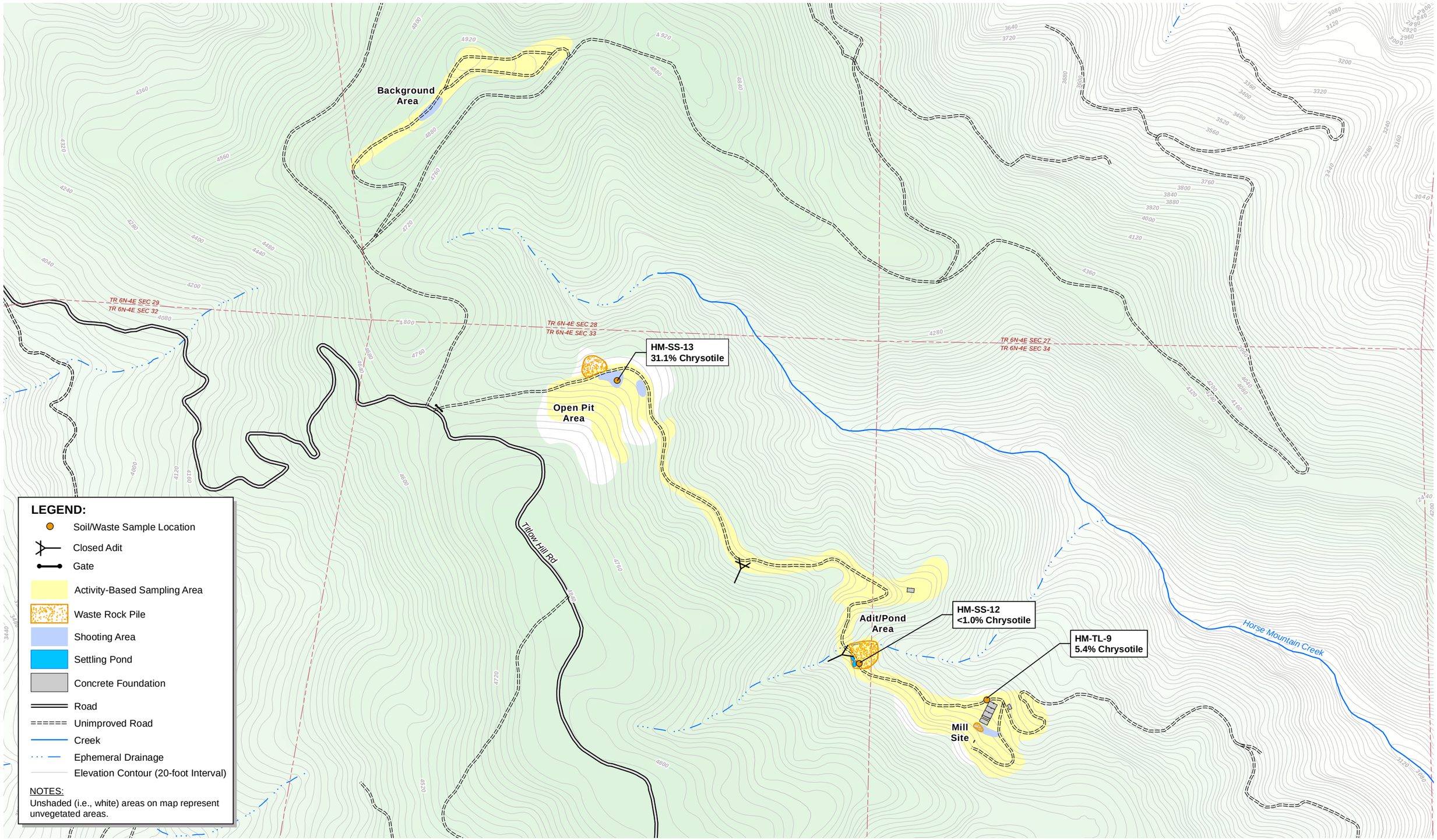

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PROJECTION: UNIVERSAL TRANSVERSE MERCATOR ZONE 10 NORTH, NORTH AMERICAN DATUM 1983

N

0 800
SCALE: 1" = 800'

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CLIENT: U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE	ACTIVITY-BASED SAMPLING AREAS			
LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST	DRAWN BY: JJC 1/22/2013	CHECKED BY: SCK 1/22/2013	PROJECT NO. 2011-119	FIG NO. 2

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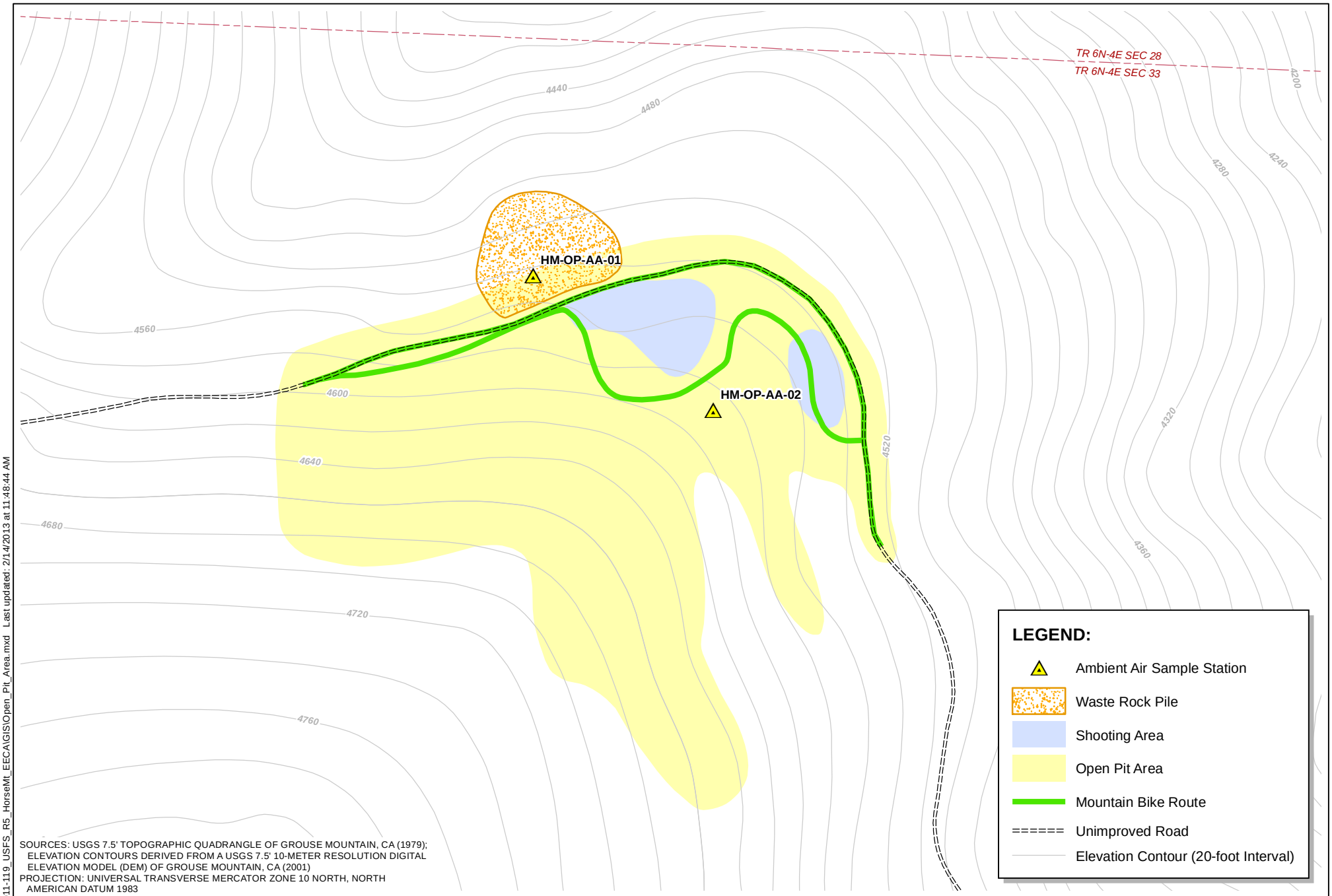

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PROJECTION: UNIVERSAL TRANSVERSE MERCATOR ZONE 10 NORTH, NORTH AMERICAN DATUM 1983

N

0 200

SCALE: 1" = 200'

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LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST

OPEN PIT AREA

DRAWN BY:	CHECKED BY:	PROJECT NO.	FIG NO.
JJC 1/22/2013	SCK 1/22/2013	2011-119	3

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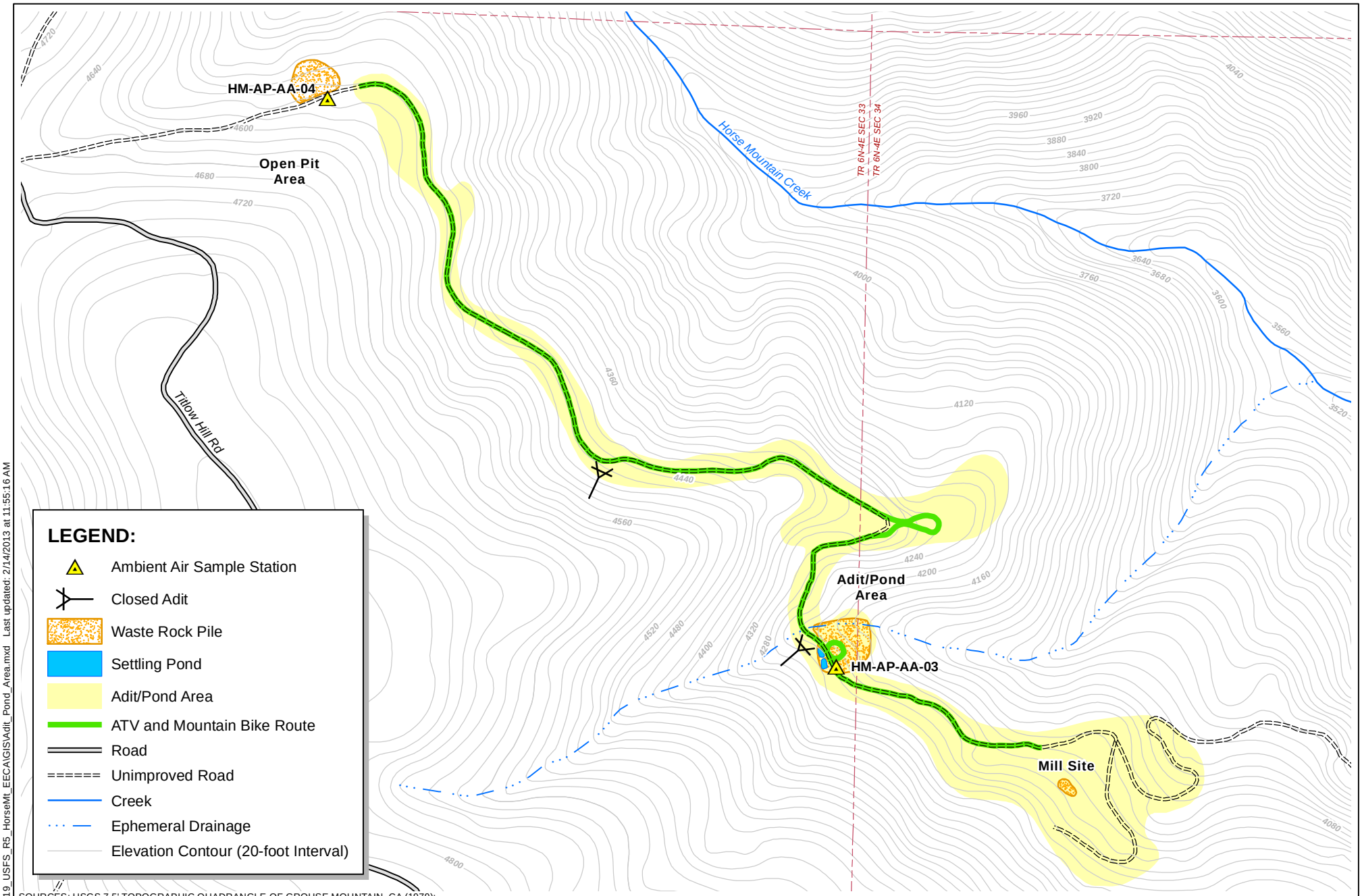

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PROJECTION: UNIVERSAL TRANSVERSE MERCATOR ZONE 10 NORTH, NORTH AMERICAN DATUM 1983

N

0 600

SCALE: 1" = 600'

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LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST

ADIT/POND AREA

DRAWN BY:	CHECKED BY:	PROJECT NO.	FIG NO.
JJC 1/22/2013	SCK 1/22/2013	2011-119	4

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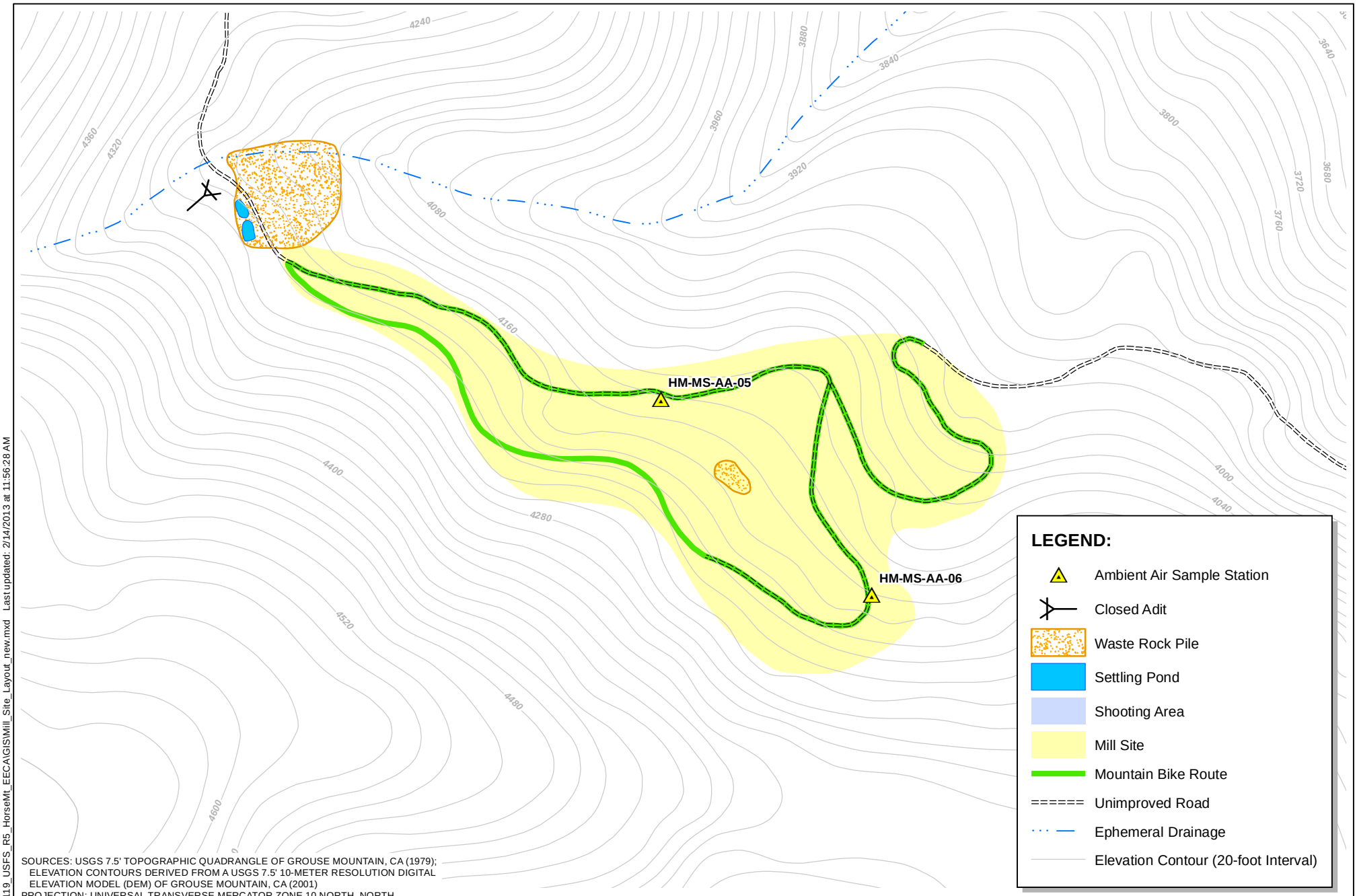

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PROJECTION: UNIVERSAL TRANSVERSE MERCATOR ZONE 10 NORTH, NORTH AMERICAN DATUM 1983

N

0 300

SCALE: 1" = 300'

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LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST

MILL SITE

DRAWN BY:	CHECKED BY:	PROJECT NO.	FIG NO.
JJC 1/22/2013	SCK 1/22/2013	2011-119	5

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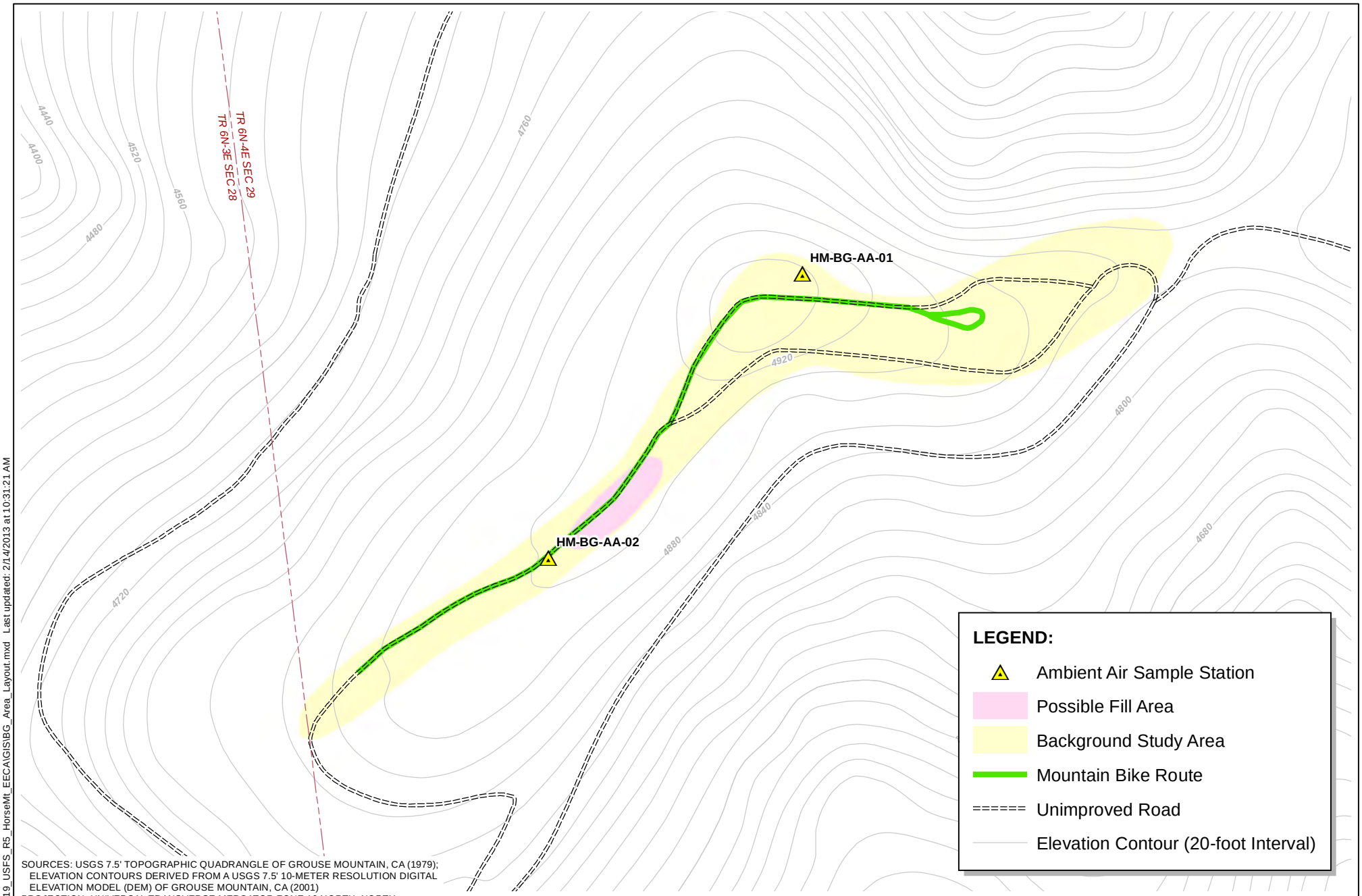

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PROJECTION: UNIVERSAL TRANSVERSE MERCATOR ZONE 10 NORTH, NORTH AMERICAN DATUM 1983

N

0 300

SCALE: 1" = 300'

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LOCATION: HORSE MOUNTAIN MINE AND MILL SITE SIX RIVERS NATIONAL FOREST

BACKGROUND AREA

DRAWN BY:	CHECKED BY:	PROJECT NO.	FIG NO.
JJC 1/22/2013	SCK 1/22/2013	2011-119	6

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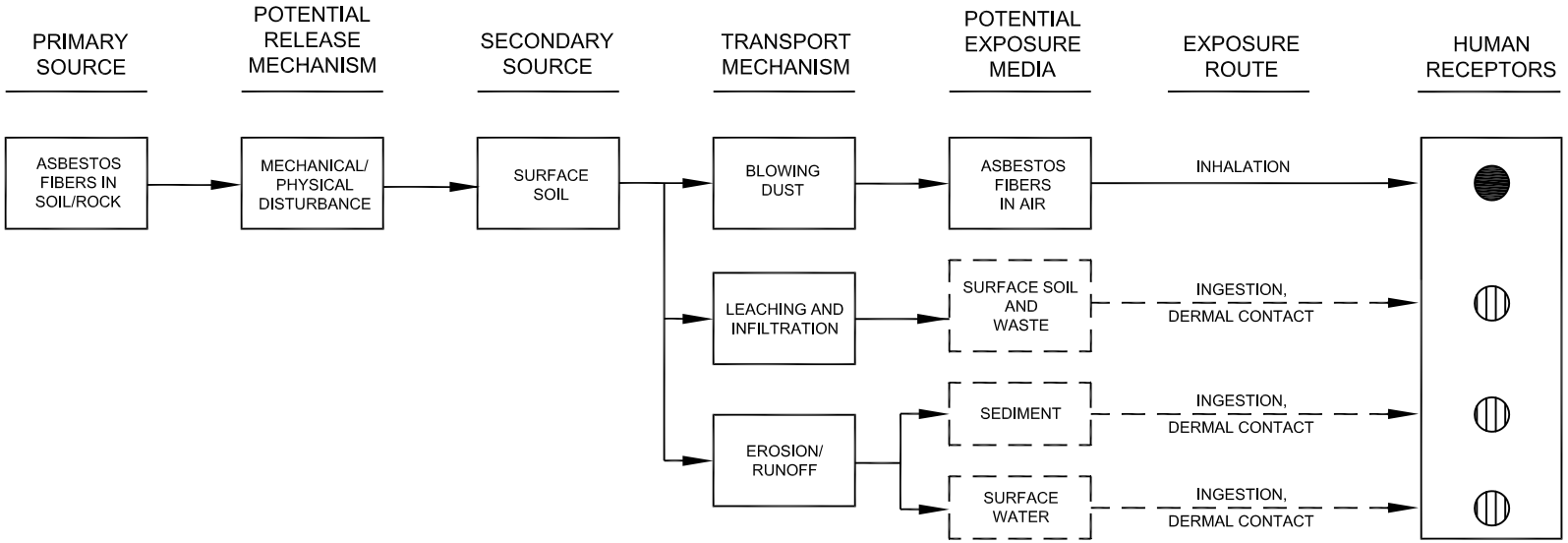

LEGEND:

- COMPLETE AND POTENTIALLY SIGNIFICANT EXPOSURE
- POTENTIALLY COMPLETE BUT INSIGNIFICANT EXPOSURE (NOT TO BE QUANTIFIED)
- INSIGNIFICANT OR INCOMPLETE PATHWAY OR MEDIUM
- POTENTIALLY SIGNIFICANT PATHWAY OR MEDIUM

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CLIENT: UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE	SITE CONCEPTUAL EXPOSURE MODEL FOR ASBESTOS			
LOCATION: HORSE MOUNTAIN MINE SITE SIX RIVERS NATIONAL FOREST, CALIFORNIA	DRAWN BY: RDB 1/25/13	CHECKED BY: ERB 1/25/13	PROJECT NO. 2011-119	FIG NO. 7

FILE NAME: N:\Graphics\2011\2011-119_USFS_R5_HorseMt_EECA\Site Conceptual Exposure Model.dwg LAYOUT NAME: Asbestos PLOTTED: Monday, January 28, 2013 - 10:16am

Enclosure 3. Tables

Table 1. Historical Weather Data

	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.	Annual
Average Maximum Temperature (ºF)	51.1	56.6	61.9	68.5	77.6	86.6	94.6	94.4	87.8	74.2	58.5	50.2	71.8
Average Minimum Temperature (ºF)	34.6	336.6	37.7	39.2	44	49	52.5	51.5	47.3	41.7	39.4	35.4	42.4
Average Total Precipitation (inch)	9.01	7.41	6.83	3.3	1.87	0.65	0.15	0.33	0.9	3.08	7.67	9.66	50.86
Average Total Snowfall (inch)	0.8	0.3	0.1	0	0	0	0	0	0	0	0.1	0.9	2.1

Notes: Period of Record 9/28/1968 - 9/27/2012

Table 2. Concentrations of Chrysotile, Amphibole, and Total Asbestos

Sample Number	Chrysotile Concentration (str/cc)	Amphibole Concentration (str/cc)	Total Asbestos Concentration (str/cc)	% Chrysotile
Mountain Biking				
HM-OP MB-01	0.0326	<0.0228	0.0326	100
HM-OP MB-02	0.0546	0.0302	0.0848	64.4
HM-OP MB-03	0.142	<0.0177	0.142	100
HM-OP MB-04	0.0194	0.0301	0.0495	39.2
HM-AP MB-01	0.0188	0.0226	0.0415	45.3
HM-AP MB-02	0.0646	<0.0114	0.0646	100
HM-AP MB-03	0.052	<0.0176	0.052	100
HM-AP MB-04	0.0577	<0.0115	0.0577	100
HM-AP MB-05	0.0568	0.0275	0.0844	67.3
HM-MS MB-01	0.0304	<0.0117	0.0304	100
HM-MS MB-02	0.0307	<0.0118	0.0307	100
HM-MS MB-03	0.0513	<0.0118	0.0513	100
HM-MS MB-04	0.0884	<0.0175	0.0884	100
Hiking				
HM-OP HK-01	0.0673	0.029	0.0962	70.0
HM-OP HK-02	0.0812	<0.0183	0.0812	100
HM-OP HK-03	0.0189	<0.0238	0.0238	100
HM-OP HK-04	0.0187	<0.0112	0.0187	100
HM-OP HK-05	0.0418	0.0295	0.0713	58.6
HM-AP HK-01	0.0802	<0.0114	0.0802	100
HM-AP HK-02	0.1091	<0.0167	0.1091	100
HM-AP HK-03	0.0447	<0.0111	0.0447	100
HM-AP HK-04	0.0908	<0.0172	0.0908	100
HM-AP HK-05	0.0295	0.0286	0.0581	50.8
HM-MS HK-01	0.0268	<0.0115	0.0268	100
HM-MS HK-02	<0.0182	<0.0115	<0.0182	--
HM-MS HK-03	<0.0234	<0.0111	<0.0234	--
HM-MS HK-04	<0.018	<0.0114	<0.018	--

Table 2. Concentrations of Chrysotile, Amphibole, and Total Asbestos *(continued)*

Sample Number	Chrysotile Concentration (str/cc)	Amphibole Concentration (str/cc)	Total Asbestos Concentration (str/cc)	% Chrysotile
ATV Riding				
HM-OP ATV-01	0.0397	<0.0228	0.0397	100
HM-OP ATV-02	0.0421	0.0421	0.0842	50
HM-OP ATV-03	0.0649	0.0296	0.0944	68.8
HM-OP ATV-04	0.0479	<0.011	0.0479	100
HM-OP ATV-05	0.0688	<0.0114	0.0688	100
HM-AP ATV-01	0.0232	0.0154	0.0386	60.1
HM-AP ATV-02	0.0994	0.0221	0.1215	81.8
HM-AP ATV-03	0.1247	0.055	0.1797	69.4
HM-AP ATV-04	0.0301	0.015	0.0451	66.7
HM-MS ATV-01	0.0808	0.0654	0.1463	55.2
HM-MS ATV-02	0.1543	0.0309	0.1852	83.3
HM-MS ATV-03	0.1726	0.022	0.1946	88.7
HM-MS ATV-04	0.1426	0.0578	0.2004	71.2
HM-MS ATV-05	0.0477	0.044	0.0917	52.0
Recreational Shooting				
HM-OP RS-01	0.0304	<0.0117	0.0304	100
HM-OP RS-02	0.0515	<0.011	0.0515	100
HM-OP RS-03	0.0554	<0.0233	0.0554	100
HM-OP RS-04	0.0599	<0.0236	0.0599	100
HM-OP RS-05	0.015	<0.0112	0.015	100
HM-MS RS-01	<0.0186	<0.0117	<0.0186	--
HM-MS RS-02	<0.0112	<0.0112	<0.0112	--
HM-MS RS-03	<0.0113	<0.0113	<0.0113	--
HM-MS RS-04	<0.0115	<0.0115	<0.0115	--
HM-MS AA-05	0.027	<0.0058	0.027	100
Background				
HM-BG MB-01	<0.0185	<0.0117	<0.0185	--
HM-BG MB-02	0.063	0.0276	0.0906	69.5
HM-BG MB-03	<0.0247	<0.0117	<0.0247	--
HM-BG MB-04	0.0635	<0.0119	0.0635	100

Table 2. Concentrations of Chrysotile, Amphibole, and Total Asbestos *(continued)*

Sample Number	Chrysotile Concentration (str/cc)	Amphibole Concentration (str/cc)	Total Asbestos Concentration (str/cc)	% Chrysotile
HM-BG HK-01	<0.0233	<0.0233	0.0233	100
Background *(continued)*				
HM-BG HK-02	0.0147	<0.011	0.0147	100
HM-BG HK-03	0.06	0.0225	0.0824	72.8
HM-BG HK-04	0.0209	0.0139	0.0348	60.1
HM-BG ATV-01	0.0626	0.0147	0.0773	81.0
HM-BG ATV-02	0.13	0.0236	0.1537	84.6
HM-BG ATV-03	0.1247	0.0234	0.1481	84.2
HM-BG ATV-04	0.0368	<0.0175	0.0368	100
HM-BG RS-01	0.0192	<0.0115	0.0192	100
HM-BG RS-02	0.0231	<0.0182	0.0231	100
HM-BG RS-03	0.0307	<0.0119	0.0307	100
HM-BG RS-04	0.031	<0.012	0.031	100
Ambient				
HM-OP AA-01	<0.0056	<0.0056	<0.0056	--
HM-OP AA-02	<0.0126	<0.006	<0.0126	--
HM-AP AA-03	0.0116	<0.0058	0.0116	100
HM-AP AA-04	0.0253	<0.0122	0.0253	100
HM-MS AA-06	0.0117	<0.0059	0.0117	100
HM-BG AA-01	0.0107	<0.0053	0.0107	100
HM-BG AA-02	<0.009	<0.0057	<0.009	--
HM-BG AA-03	<0.0054	<0.0054	<0.0054	--

Notes:
str/cc = strands per cubic centimeter
-- = not applicable or not available
< = nondetect at a concentration less than the reporting limit

Table 3. Exposure Parameters for Receptors

Receptor	Age	Exposure Time (hours/day)	Exposure Frequency (days/year)	Age at Which Exposure Begins (years)	Exposure Duration (years)	TWF	IUR $(str/cc)^{-1}$
Mountain Biker	Adult	3	39	15	30	0.0134	9.3E-02
	Child	3	39	5	10	0.0134	7.0E-02
Hiker	Adult	2	39	15	30	0.0089	9.3E-02
	Child	2	39	5	10	0.0089	7.0E-02
ATV Rider	Adult	6	39	15	30	0.0267	9.3E-02
	Child	6	39	5	10	0.0267	7.0E-02
Recreational Shooter	Adult	1	117	15	30	0.0134	9.3E-02
	Child	1	117	5	10	0.0134	7.0E-02

Notes
ATV = all-terrain vehicle
IUR = inhalation unit risk in $(str/cc)^{-1}$
str/cc = structures per cubic centimeter
TWF = time weighting factor

Table 4. Asbestos Results for Activity-Based Air Samples

Sample Number	Area	Height	Position[a]	Number of PCME Fibers	Analytical Sensitivity (str/cc)	PCME Concentration (str/cc)	ELCR
			Mountain Biking				
HM-OP MB-01	Open Pit	Adult	Lead	11	0.0036	0.0326	**4.E-05**
HM-OP MB-02	Open Pit	Child	Lead	17	0.0039	0.0848	**8.E-05**
HM-OP MB-03	Open Pit	Adult	Follow	39	0.0037	0.142	**2.E-04**
HM-OP MB-04	Open Pit	Child	Follow	8	0.0039	0.0495	**5.E-05**
HM-AP MB-01	Adit/Pond	Adult	Lead	11	0.0038	0.0415	**5.E-05**
HM-AP MB-05	Adit/Pond - Duplicate	Adult	Lead	19	0.0036	0.0844	**1.E-04**
HM-AP MB-02	Adit/Pond	Child	Lead	18	0.0038	0.0646	**6.E-05**
HM-AP MB-03	Adit/Pond	Adult	Follow	15	0.0037	0.052	**6.E-05**
HM-AP MB-04	Adit/Pond	Child	Follow	15	0.0038	0.0577	**5.E-05**
HM-MS-MB-01	Mill Site	Adult	Lead	3	0.0039	0.0304	**4.E-05**
HM-MS MB-02	Mill Site	Child	Lead	3	0.004	0.0307	**3.E-05**
HM-MS MB-03	Mill Site	Adult	Follow	13	0.0039	0.0513	**6.E-05**
HM-MS MB-04	Mill Site	Child	Follow	25	0.0037	0.0884	**8.E-05**
			Hiking				
HM-OP HK-01	Open Pit	Adult	Lead	21	0.0037	0.0962	**8.E-05**
HM-OP HK-02	Open Pit	Child	Lead	22	0.0039	0.0812	**5.E-05**
HM-OP HK-03	Open Pit	Adult	Follow	7	0.0038	0.0238	**2.E-05**
HM-OP HK-05	Open Pit - Duplicate	Adult	Follow	14	0.0038	0.0713	**6.E-05**
HM-OP HK-04	Open Pit	Child	Follow	5	0.0037	0.0187	**1.E-05**
HM-AP HK-01	Adit/Pond	Adult	Lead	21	0.0038	0.0802	**7.E-05**

Table 4. Asbestos Results for Activity-Based Air Samples *(continued)*

Sample Number	Area	Height	Position[a]	Number of PCME Fibers	Analytical Sensitivity (str/cc)	PCME Concentration (str/cc)	ELCR
			Hiking *(continued)*				
HM-AP HK-02	Adit/Pond	Child	Lead	32	0.0035	0.1091	**7.E-05**
HM-AP HK-03	Adit/Pond	Adult	Follow	12	0.0037	0.0447	**4.E-05**
HM-AP HK-05	Adit/Pond - Duplicate	Adult	Follow	11	0.0037	0.0581	**5.E-05**
HM-AP HK-04	Adit/Pond	Child	Follow	26	0.0036	0.0908	**6.E-05**
HM-MS HK-01	Mill Site	Adult	Lead	7	0.0038	0.0268	**2.E-05**
HM-MS HK-02	Mill Site	Child	Lead	1	0.0038	<0.0182	NA
HM-MS HK-03	Mill Site	Adult	Follow	2	0.0037	<0.0234	NA
HM-MS HK-04	Mill Site	Child	Follow	1	0.0038	<0.018	NA
			ATV Riding				
HM-OP ATV-01[b]	Open Pit	Adult	Lead	13	0.0036	0.0397	**1.E-04**
HM-OP ATV-02[b]	Open Pit	Child	Lead	14	0.0039	0.0908	**2.E-04**
HM-OP ATV-05[b]	Open Pit - Duplicate	Child	Lead	18	0.0038	0.0688	**1.E-04**
HM-OP ATV-03	Open Pit	Adult	Follow	20	0.0038	0.0944	**2.E-04**
HM-OP ATV-04[b]	Open Pit	Child	Follow	13	0.0037	0.0479	**9.E-05**
HM-AP ATV-01[b]	Adit/Pond	Adult	Lead	10	0.0039	0.0386	**1.E-04**
HM-AP ATV-02[b]	Adit/Pond	Child	Lead	33	0.0037	0.1215	**2.E-04**
HM-AP ATV-03	Adit/Pond	Adult	Follow	49	0.0037	0.1797	**4.E-04**
HM-AP ATV-04[b]	Adit/Pond	Child	Follow	11	0.0038	0.0451	**8.E-05**
HM-MS ATV-01[b]	Mill Site	Adult	Lead	37	0.0038	0.1463	**4.E-04**
HM-MS ATV-02	Mill Site	Child	Lead	48	0.0039	0.1852	**3.E-04**

Table 4. Asbestos Results for Activity-Based Air Samples *(continued)*

Sample Number	Area	Height	Position[a]	Number of PCME Fibers	Analytical Sensitivity (str/cc)	PCME Concentration (str/cc)	ELCR
			ATV Riding *(continued)*				
HM-MS ATV-03[b]	Mill Site	Adult	Follow	53	0.0037	0.1946	**5.E-04**
HM-MS ATV-04	Mill Site	Child	Follow	52	0.0039	0.2004	**4.E-04**
HM-MS ATV-05	Mill Site - Duplicate	Child	Follow	25	0.0037	0.0917	**2.E-04**
			Recreational Shooting				
HM-OP RS-01	Open Pit	Adult	Lead	3	0.0039	0.0304	**4.E-05**
HM-OP RS-02	Open Pit	Child	Lead	14	0.0037	0.0515	**5.E-05**
HM-OP RS-03	Open Pit	Adult	Follow	17	0.0037	0.0554	**7.E-05**
HM-OP RS-05	Open Pit - Duplicate	Adult	Follow	4	0.0038	0.015	**2.E-05**
HM-OP RS-04	Open Pit	Child	Follow	18	0.0037	0.0599	**6.E-05**
HM-MS RS-01	Mill Site	Adult	Lead	1	0.0039	<0.0186	NA
HM-MS RS-02	Mill Site	Child	Lead	0	0.0037	<0.0112	NA
HM-MS RS-03	Mill Site	Adult	Follow	0	0.0038	<0.0113	NA
HM-MS RS-04	Mill Site	Child	Follow	0	0.0039	<0.0115	NA

Notes:

Italicized text = indicates duplicate pairs

Shaded = Indicates the risk exceeds the upper end of the risk management range (1E-04)

Bold = Indicates the risk is within the risk management range (1E-06 to 1E-04)

a = Indicates if the receptor is in the lead or follow position for the specified activity

b = particulate loading on the filter exceeds 25 percent, possible low bias

ATV = all-terrain vehicle

ELCR = excess lifetime cancer risk

NA = not available

PCME = phase contrast microscopy equivalent

str/cc = structures per cubic centimeter

< = nondetect at a concentration less than the reporting limit

Table 5. Asbestos Results for Activity-Based Air Samples in the Background Area

Sample Number	Activity	Height	Position[a]	Number of PCME Fibers	Analytical Sensitivity (str/cc)	PCME Concentration (str/cc)	ELCR
HM-BG MB-01	Mountain Bike	Adult	Lead	1	0.0039	<0.0185	NA
HM-BG MB-02	Mountain Bike	Child	Lead	23	0.0039	0.0906	**8.E-05**
HM-BG MB-03	Mountain Bike	Adult	Follow	2	0.0039	<0.0247	NA
HM-BG MB-04	Mountain Bike	Child	Follow	16	0.004	0.0635	**6.E-05**
HM-BG HK-01	Hiking	Adult	Lead	4	0.0037	0.0233	**2.E-05**
HM-BG HK-02	Hiking	Child	Lead	4	0.0037	0.0147	**9.E-06**
HM-BG HK-03	Hiking	Adult	Follow	22	0.0037	0.0824	**7.E-05**
HM-BG HK-04	Hiking	Child	Follow	10	0.0035	0.0348	**2.E-05**
HM-BG ATV-01[b]	ATV	Adult	Lead	21	0.0037	0.0773	**2.E-04**
HM-BG ATV-02[b]	ATV	Child	Lead	39	0.0039	0.1537	**3.E-04**
HM-BG ATV-03[b]	ATV	Adult	Follow	38	0.0039	0.1481	**4.E-04**
HM-BG ATV-04	ATV	Child	Follow	14	0.0037	0.0368	**7.E-05**
HM-BG RS-01	Recreational Shooting	Adult	Lead	5	0.0038	0.0192	**2.E-05**
HM-BG RS-02	Recreational Shooting	Child	Lead	7	0.0038	0.0231	**2.E-05**
HM-BG RS-03	Recreational Shooting	Adult	Follow	3	0.004	0.0307	**4.E-05**
HM-BG RS-04	Recreational Shooting	Child	Follow	3	0.004	0.031	**3.E-05**

Notes:

Shaded = Indicates the risk exceeds the upper end of the risk management range (1E-04)

Bold = Indicates the risk is within the risk management range (1E-06 to 1E-04)

a = Indicates if the receptor is in the lead or follow position for the specified activity

b = particulate loading on the filter exceeds 25 percent, possible low bias

ATV = all-terrain vehicle

ELCR = excess lifetime cancer risk

NA = not available

PCME = phase contrast microscopy equivalent

str/cc = structures per cubic centimeter

< = nondetect at a concentration less than the reporting limit

Table 6. Asbestos Results for Ambient Air Samples

Sample Number	Area	Number of PCME Fibers	Analytical Sensitivity (str/cc)	PCME Concentration (str/cc)
HM-OP AA-01	Open Pit	0	0.0019	<0.0056
HM-OP AA-02	Open Pit	2	0.002	<0.0126
HM-AP AA-03	Adit/Pond	6	0.0019	0.0116
HM-AP AA-04	Adit/Pond	15	0.0019	0.0253
HM-MS AA-05	Mill Site	14	0.0019	0.027
HM-MS AA-06	Mill Site	6	0.002	0.0117
HM-BG AA-01	Background	6	0.0018	0.0107
HM-BG AA-02	Background	1	0.0019	<0.009
HM-BG AA-03	Duplicate	0	0.0018	<0.0054

Notes:

Italicized text = indicates duplicate pairs

PCME = phase contrast microscopy equivalent

str/cc = structures per cubic centimeter

< = nondetect at a concentration less than the reporting limit

Table 7. Summary of Asbestos Risk for Activity-Based Air Samples

Sampling Area	Activity							
	Mountain Biking		Hiking		ATV Riding		Recreational Shooting	
	Adult	Child	Adult	Child	Adult	Child	Adult	Child
Open Pit (lead)	**4.E-05**	**8.E-05**	**8.E-05**	**5.E-05**	**1.E-04**	**2.E-04**	**4.E-05**	**5.E-05**
Open Pit (follow)	**2.E-04**	**5.E-05**	**6.E-05**	**1.E-05**	**2.E-04**	**9.E-05**	**7.E-05**	**6.E-05**
Adit/Pond (lead)	**1.E-04**	**6.E-05**	**7.E-05**	**7.E-05**	**1.E-04**	**2.E-04**	N/S	N/S
Adit/Pond (follow)	**6E-05)**	**5.E-05**	**5.E-05**	**6.E-05**	**4.E-04**	**8.E-05**	N/S	N/S
Mill Site (lead)	**4.E-05**	**3.E-05**	**2.E-05**	NA	**4.E-04**	**3.E-04**	NA	NA
Mill Site (follow)	**6.E-05**	**8.E-05**	NA	NA	**5.E-04**	**4.E-04**	NA	NA
Background (lead)	NA	**8.E-05**	**2.E-05**	**9.E-06**	**2.E-04**	**3.E-04**	**2.E-05**	**2.E-05**
Background (follow)	NA	**6.E-05**	**7.E-05**	**2.E-05**	**4.E-04**	**7.E-05**	**4.E-05**	**3.E-05**

Notes:

Shaded = Indicates the risk exceeds the upper end of the risk management range (1E-04)

Bold = Indicates the risk is within the risk management range (1E-06 to 1E-04)

ATV = all-terrain vehicle

NA = not applicable; asbestos structures were not detected in activity-based samples, thus risk could not be quantified

N/S = activity-based samples were not collected for this activity at this area of the site

Enclosure 4. Photographic Log

Photograph 1: Closeup of surface material at Open Pit with shooting debris, facing down
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph 2: Overview of surface material at Open Pit, facing south
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph 3: Road between Open Pit and adjacent shooting area to the east, facing west

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph 4: Surface material at Open Pit, facing southwest

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph 5: ATV tracks from activity-based sampling at Open Pit, facing down
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph 6: Ambient air sampling station in the southern part of the Open Pit, facing north
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph 7: Activity-based sampling in progress; mountain biking activity in the Open Pit area (on the main road west of the Open Pit), facing east.
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph 8: Activity-based sampling in progress; ATV riding activity at the Open Pit, facing south

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 6, 2012

Photograph 9: ATV sampling set up at Open Pit with ATVs and tire marks at right, facing northwest

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 7, 2012

Photograph 10: Open Pit overview from the background area, facing south.
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 11, 2012

Photograph 11: Surface material (mine waste) at Adit/Pond Area, facing down
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 10, 2012

Photograph 12: Setting up for activity-based sampling (mountain biking) at road turnout at Adit Pond area, facing southwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 10, 2012

Photograph 13: Surface material along main access road at Adit/Pond Area, (settling ponds at left, truck in turnout), facing northwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 10, 2012

Photograph 14: Surface material along main access road at Adit/Pond Area adjacent to impoundment ponds, facing southeast
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 10, 2012

Photograph 15: Surface material at Adit/Pond waste pile, along hiking route, facing southwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 10, 2012

Photograph 16: Surface material at Adit/Pond waste pile along hiking route, facing west
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 10, 2012

Photograph 17: Surface material along road south of Adit/Pond, north of Mill Site, included in activity-based sampling for Adit/Pond Area, facing northwest

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 10, 2012

Photograph 18: Ambient air station at south end of Mill Site, facing east
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 5, 2012

Photograph 19: Ambient air station at north side of Mill Site, facing south
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 5, 2012

Photograph 20: Activity-based sampling in progress; hiking at the Mill Site, facing southwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Spencer Johnson (ERRG) Date: September 5, 2012

Photograph 21: Activity-based sampling in progress; mountain biking at the Mill Site, facing northwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 9, 2012

Photograph 22: Activity-based sampling in progress; mountain biking along road at the Mill Site, facing northwest

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 9, 2012

Photograph 23: Activity-based sampling in progress; mountain biking along road at the Mill Site, facing southeast

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 9, 2012

Photograph 24: Preparing for activity-based sampling using ATVs at the Mill Site, facing northwest

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 5, 2012

Photograph 25: Surface material observed across approximately 80% of background area (similar composition and grain size to materials at the site), facing west
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Spencer Johnsons (ERRG) Date: September 9, 2012

Photograph 26: Surface material observed across approximately 20% of background area (may represent imported fill material), facing southwest
Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA
Photographed by: Samantha Caruthers-Knight (ERRG) Date: September 12, 2012

Photograph 27: Activity-based sampling in progress; mountain biking at background area, facing southwest

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Spencer Johnson (ERRG) Date: September 11, 2012

Photograph 28: Activity-based sampling in progress; ATV riding at background area, facing west

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Spencer Johnson (ERRG) Date: September 9, 2012

Photograph 29: Activity-based sampling in progress; ATV riding at background area, facing northeast

Horse Mountain Mine and Mill Site, Six Rivers National Forest, Humboldt County, CA

Photographed by: Spencer Johnson (ERRG) Date: September 9, 2012

Enclosure 5. Alternative SRE Table 1

Table 1. Alternative Risk Assessment Summary of Asbestos Risk for Activity-Based Air Samples

	Activity							
	Mountain Biking		Hiking		ATV Riding		Recreational Shooting	
Sampling Area	Adult	Child	Adult	Child	Adult	Child	Adult	Child
Open Pit	**2E-05 (lead)**	**3E-05 (lead)**	**3E-05 (lead)**	**2E-05 (lead)**	**4E-05 (lead)**	**7E-05 (lead)**	**2E-05 (lead)**	**2E-05 (lead)**
	8E-05 (follow)	**2E-05 (follow)**	**9E-06 (follow)**	**5E-06 (follow)**	**1E-04 (follow)**	**4E-05 (follow)**	**3E-05 (follow)**	**2E-05 (follow)**
Adit/Pond	**2E-05 (lead)**	**3E-05 (lead)**	**3E-05 (lead)**	**3E-05 (lead)**	**4E-05 (lead)**	**1E-04 (lead)**	N/S	N/S
	3E-05 (follow)	**2E-05 (follow)**	**2E-05 (follow)**	**2E-05 (follow)**	**2E-04 (follow)**	**4E-05 (follow)**	N/S	N/S
Mill Site	**2E-05 (lead)**	**1E-05 (lead)**	**1E-05 (lead)**	NA NA	**2E-04 (lead)**	**2E-04 (lead)**	NA	NA NA
	3E-05 (follow)	**4E-05 (follow)**	NA	NA	**2E-04 (follow)**	**2E-04 (follow)**	NA	NA
Background	NA	**4E-05 (lead)**	**8E-06 (lead)**	**4E-06 (lead)**	**8E-05 (lead)**	**1E-04 (lead)**	**1E-05 (lead)**	**9E-06 (lead)**
	NA	**3E-05 (follow)**	**3E-05 (follow)**	**9E-06 (follow)**	**2E-04 (follow)**	**3E-05 (follow)**	**2E-05 (follow)**	**1E-05 (follow)**

Notes:

Shaded = indicates the risk exceeds the upper end of the risk management range (1E-04)

Bold = indicates the risk is within the risk management range (1E-06 to 1E-04)

ATV = all-terrain vehicle

NA = not applicable; asbestos structures were not detected in activity-based samples, thus risk could not be quantified

N/S = activity-based samples were not collected for this activity at this area

Appendix D. Detailed Cost Estimate

Table D-1. Alternatives Cost Estimate Summary

Site: Horse Mountain Mine and Mill Site
Location: Six Rivers National Forest, Humboldt County, California
Phase: EE/CA (-30% / +50%)

Remedial Alternative	Total Capital Cost	Total O&M Cost (30 Years)	Total Periodic Cost	Period of Analysis[2]	Total Cost[3]	Present Value Cost[4]	Range for -30% / +50%		
1	$ -	$ -	$ -	30 years	$ -	$ -	$ -	to	$ -
2A	$ 1,476,288	$ 501,600	$ 234,000	30 years	$ 2,211,888	$ 2,017,535	$ 1,412,275	to	$ 3,026,303
2B	$ 1,670,760	$ 547,200	$ 256,500	30 years	$ 2,474,460	$ 2,261,923	$ 1,583,346	to	$ 3,392,884
3A	$ 1,362,203	$ 570,000	$ 279,000	30 years	$ 2,211,203	$ 1,986,260	$ 1,390,382	to	$ 2,979,390
3B	$ 1,649,528	$ 615,600	$ 312,000	30 years	$ 2,577,128	$ 2,330,978	$ 1,631,685	to	$ 3,496,467
4	$ 7,907,914	$ 11,400	$ -	30 years	$ 7,919,314	$ 7,919,090	$ 5,543,363	to	$ 11,878,636

Notes:

(1) Appended tables summarize backup calculations for all cost estimates provided.

(2) Period of analysis assumes the base year is 2013.

(3) Total cost includes a 25 percent contingency factor to account for changes in scope, changes to bid quantites, and inflation.

(4) Based on a 2.0 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2011) at http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html.

Table D-2. Alternative 2A - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 2A (Excavation and Single Onsite Encapsulation Unit - Soil Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Implementation Plans/Setup	1	LS	$25,000	$25,000.00	Includes 10 days for Technical Staff to complete pre-mobilization plans (including Work Plan and HASP with graphics, review, and production).
Design	1	LS	$75,000	$75,000.00	Includes 35 days for Technical Staff to complete the design of repository cap, geotechnical and chemical testing of import backfill, and excavation and creek bank restoration process. Includes surveys and plan to reduce risk from Port-Orford-cedar root disease.
Mobilization and Demobilization	1	LS	$105,000	$105,000.00	Mobilization and demobilization of crew, materials, and equipment. Includes costs for sanitary facilities, storage facilities, air monitoring equipment, and other project necessities. Craft trade crew of 10 plus 1 technical person for 4 days. Includes costs for RVs and level C PPE for the duration of work.
Site Work					
Mill Foundation Demolition	1	LS	$85,000.00	$85,000	Includes 10 days for demolition of concrete foundation at Mill Area using 1 excavator, 1 backhoe with breaker, and 1 loader.
Creek Diversion	1	LS	$12,000.00	$12,000	Includes 2 days to place temporary sandbags in the creek on the upstream side of the work area to divert creek water away from waste removal activities. To be removed when backfill and restoration is complete.
Excavation of Contaminated Material	31,500	BCY	$2.43	$76,680	RS Means Heavy Construction Cost Data 2013, 31 23 16.42 0300. This assumes an excavator, hydraulic, crawler mtd., 3 cy capacity, and 2,080 cy/day. Price inflated $0.50 per cy for difficult excavation on slope.
Load and Haul Waste to Repository	31,500	BCY	$7.56	$238,075	RS Means Heavy Construction Cost Data 2013, G1030 140 3400. Load and haul common earth, 3.5 cy track loader, four 20 cy dump trailers, 1 mile roundtrip (weighted average). Price inflated $0.50 per cy for 1.5 mile round trip (weighted
Collect Confirmation Samples	1	LS	$4,500.00	$4,500	Assumes 2 days of Confirmation Sampling and XRF Rental.
Import Clean Cover Material	7,600	TN	$15.00	$114,000	Verbal quote from R. Brown Construction in Willow Creek, CA. Assumes site is accessible by truck.
Encapsulation of Repository	4,750	BCY	$1.37	$6,514	RS Means Heavy Construction Cost Data 2013, 31 23 23.14 4020 Backfill, structural, 200 HP dozer, 50' haul, common earth + 31 23 23.23 5060 Compaction, riding, vibrating roller, 12" lifts, two passes.
Demarcation Fabric	64,000	SF	$0.20	$12,800	Install single layer Mirafi 140N at 1 ft depth during encapsulation.
Grading Disturbed Waste Removal Areas	17,835	SY	$0.21	$3,792	RS Means Heavy Construction Cost Data 2013, 31 22 16.10 3300 Finish Grading, slopes, gentle.
Erosion Control Fabric	24,945	SY	$2.19	$54,624	RS Means Heavy Construction Cost Data 2013, 31 25 14.16 0020 Rolled erosion control mats and blankets, jute mesh, 100 sy per roll, 4' wide, stapled.
Straw Wattle	15,000	LF	$1.20	$18,000	Install wattle along slopes of encapsulated and restored areas, placed along 15ft contours.
Riprap at Bottom of Creek Bank	10	TN	$35.61	$356	RS Means Heavy Construction Cost Data 2013, 31 37 13.10 0300 Rip rap and rock lining, dumped, 50 lb. average.
Hydroseeding (Grass) of Disturbed and Graded Areas	225	MSF	$57.40	$12,887	RS Means Heavy Construction Cost Data 2013, 32 92 19.14 4600 Seeding, slope mix, 6#/M.S.F., hydro- or air seeding, with mulch and fertilizer.
Dust Suppression	3.75	MO	$30,000.00	$112,500	One 4,000-gallon water truck spraying water for dust suppression during all phases of work. Includes operator costs.
After Action Report	1	LS	$20,000	$20,000.00	Includes 10 days for Technical Staff to write a completion report, including graphics, review, and production.
SUBTOTAL				**$976,726**	
Contingency	25%			$244,182	15% scope + 10% bid
SUBTOTAL				**$1,220,908**	
Project Management	10%			$97,672.65	Includes project management during all phases of construction, regulatory interface, permitting, and crew per diems.
Construction Management	12%			$117,207.18	Includes construction management, quality control, geotechnical testing, and quality control testing.
SUBTOTAL					
Institutional Controls	1	LS	$40,500	$40,500	Forest Plan amendment, legal description for ARIC, and legal fees. Includes reproduction.
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$1,476,288**	

Table D-2. Alternative 2A - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 2A (Excavation and Single Onsite Encapsulation Unit - Soil Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Inspections and Maintenance					
Biannual Inspections	2	LS	$ 2,000	$ 4,000	Biannual inspections to evaluate the integrity of all cover elements and stormwater BMPs.
Minor Repairs	1	LS	$ 7,000	$ 7,000	Replace erosion control fabric or other BMPs.
SUBTOTAL				**$11,000**	
Contingency	25%			$ 2,750	10% scope + 15% bid
SUBTOTAL				**$13,750**	
Project Management	10%			$1,100	
Contractor Overhead	7%			$770	
Profit	10%			$1,100	
		TOTAL ANNUAL O&M COSTS:		**$16,720**	per year
		TOTAL ANNUAL O&M COSTS:		**$501,600**	Years 1-30

PERIODIC COSTS	**Year**					
Five-Year Review Report	5	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 5.
Significant Repairs	5	1	LS	$15,000	$15,000.00	Costs for significant repairs and encapsulation BMPs.
SUBTOTAL (YEAR 5)					**$34,000.00**	
Five-Year Review Report	10	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 10.
Major Repairs	10	1	LS	$25,000	$25,000.00	Costs for major repairs to encapsulation.
SUBTOTAL (YEAR 10)					**$44,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 15.
Significant Repairs	15	1	LS	$15,000	$15,000.00	Costs for significant repairs and encapsulation BMPs.
SUBTOTAL (YEAR 15)					**$34,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 20.
Major Repairs	20	1	LS	$25,000	$25,000.00	Costs for major repairs to encapsulation.
SUBTOTAL (YEAR 20)					**$44,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 25.
Significant Repairs	15	1	LS	$15,000	$15,000.00	Costs for significant repairs and encapsulation BMPs.
SUBTOTAL (YEAR 25)					**$34,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 30.
Major Repairs	20	1	LS	$25,000	$25,000.00	Costs for major repairs to encapsulation.
SUBTOTAL (YEAR 30)					**$44,000.00**	

Table D-2. Alternative 2A - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 2A (Excavation and Single Onsite Encapsulation Unit - Soil Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)	PRESENT VALUE
Capital Cost	0	$ 1,476,288	$ 1,476,288	1.000	$ 1,476,288
Annual O&M Cost	1-30	$ 501,600	$16,720	0.747	$374,468.74
Periodic Cost	5	$34,000.00	$ 34,000	0.906	$ 30,795
Periodic Cost	10	$44,000.00	$ 44,000	0.820	$ 36,095
Periodic Cost	15	$34,000.00	$ 34,000	0.743	$ 25,263
Periodic Cost	20	$44,000.00	$ 44,000	0.673	$ 29,611
Periodic Cost	25	$34,000.00	$ 34,000	0.610	$ 20,724
Periodic Cost	30	$44,000.00	$ 44,000	0.552	$ 24,291
		$2,211,888			$2,017,535
TOTAL PRESENT VALUE OF SELECTED REMEDY				**$2,017,535**	

Notes:

1. Source: Office of Management and Budget, 2008. OMB Circular No. A-94. January. Online at: <http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html>.
2. Source: RS Means Heavy Construction Cost Data 2013
3. RS Means Costs were multiplied by a factor of 1.063 to account for a Eureka, CA localization factor. (p. 613)
4. Based on a 2.0 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2012)

BCY= bank cubic yard
BMPs = best management practices
cy = cubic yard
LS = lump sum
MO = month
MSF = 1000 square feet
O&M = operation and maintenance
RV = recreational vehicle
SF = square feet
SY = square yard
TN = ton

Table D-3. Alternative 2A - Cash Flow Analysis

Year	Periodic Cost	Annual Cost	Discount Factor	Actual Periodic Cost	Actual Annual Cost
1		$16,720	0.980392157		$16,392.16
2		$16,720	0.961168781		$16,070.74
3		$16,720	0.942322335		$15,755.63
4		$16,720	0.923845426		$15,446.70
5	$34,000	$16,720	0.90573081	$30,794.85	$15,143.82
6		$16,720	0.887971382		$14,846.88
7		$16,720	0.870560179		$14,555.77
8		$16,720	0.853490371		$14,270.36
9		$16,720	0.836755266		$13,990.55
10	$44,000	$16,720	0.8203483	$36,095.33	$13,716.22
11		$16,720	0.804263039		$13,447.28
12		$16,720	0.788493176		$13,183.61
13		$16,720	0.773032525		$12,925.10
14		$16,720	0.757875025		$12,671.67
15	$34,000	$16,720	0.74301473	$25,262.50	$12,423.21
16		$16,720	0.728445814		$12,179.61
17		$16,720	0.714162562		$11,940.80
18		$16,720	0.700159375		$11,706.66
19		$16,720	0.68643076		$11,477.12
20	$44,000	$16,720	0.672971333	$29,610.74	$11,252.08
21		$16,720	0.659775817		$11,031.45
22		$16,720	0.646839036		$10,815.15
23		$16,720	0.634155918		$10,603.09
24		$16,720	0.621721488		$10,395.18
25	$34,000	$16,720	0.609530871	$20,724.05	$10,191.36
26		$16,720	0.597579285		$9,991.53
27		$16,720	0.585862044		$9,795.61
28		$16,720	0.574374553		$9,603.54
29		$16,720	0.563112307		$9,415.24
30	$44,000	$16,720	0.552070889	$24,291.12	$9,230.63

Table D-4. Alternative 2B - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 2B (Excavation and Single Onsite Encapsulation Unit - Asphalt Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Implementation Plans/Setup	1	LS	$25,000	$25,000.00	Includes 10 days for Technical Staff to complete pre-mobilization plans (including Work Plan and HASP with graphics, review, and production).
Design	1	LS	$75,000	$75,000.00	Includes 35 days for Technical Staff to complete the design of repository cap and excavation and creek bank restoration process. Includes surveys and plan to reduce risk from Port-Orford-cedar root disease.
Mobilization and demobilization	1	LS	$100,000	$100,000.00	Mobilization and demobilization of crew, materials, and equipment. Includes costs for sanitary facilities, storage facilities, air monitoring equipment, and other project necessities. Craft trade crew of 10 plus 1 technical person for 4 days. Includes costs for RVs and level C PPE for the duration of work.
Site Work					
Mill Foundation Demolition	1	LS	$85,000.00	$85,000	Includes 10 days for demolition of concrete foundation at Mill Area using 1 excavator, 1 backhoe with breaker, and 1 loader.
Creek Diversion	1	LS	$12,000.00	$12,000	Includes 2 days to place temporary sandbags in the creek on the upstream side of the work area to divert creek water away from waste removal activities. To be removed when backfill and restoration is complete.
Excavation of Contaminated Material	31,500	BCY	$2.43	$76,680	RS Means Heavy Construction Cost Data 2013, 31 23 16.42 0300. This assumes an excavator, hydraulic, crawler mtd., 3 cy capacity, and 2,080 cy/day. Price inflated $0.50 per cy for difficult excavation on slope.
Load and Haul Waste to Repository	31,500	BCY	$7.56	$238,075	RS Means Heavy Construction Cost Data 2013, G1030 140 3400. Load and haul common earth, 3.5 cy track loader, four 20 cy dump trailers, 1 mile roundtrip (weighted average). Price inflated $0.50 per cy for 1.5 mile round trip (weighted average).
Grading Repository Area	7,200	SY	$0.21	$1,531	RS Means Heavy Construction Cost Data 2013, 31 22 16.10 3300 Finish Grading, slopes, gentle.
Collect Confirmation Samples	1	LS	$4,500.00	$4,500	Assumes 2 days of Confirmation Sampling and XRF Rental.
Demarcation Fabric	64,000	SF	$0.20	$12,800	Install single layer Mirafi 140N between waste and asphalt cap.
Asphalt Cap	64,000	SF	$4.62	$295,680	Verbal quote from Mercer Fraser, Willow Creek, CA. 6" base, 2" binder, 4" top installed.
Grading Disturbed Waste Removal Areas	17,835	SY	$0.21	$3,792	RS Means Heavy Construction Cost Data 2013, 31 22 16.10 3300 Finish Grading, slopes, gentle.
Erosion Control Fabric	17,835	SY	$2.19	$39,055	RS Means Heavy Construction Cost Data 2013, 31 25 14.16 0020 Rolled erosion control mats and blankets, jute mesh, 100 sy per roll, 4' wide, stapled.
Straw Wattle	10,700	LF	$1.20	$12,840	Install wattle along slopes of restored areas, placed along 15ft contours.
Riprap at Bottom of Creek Bank	10	TN	$35.61	$356	RS Means Heavy Construction Cost Data 2013, 31 37 13.10 0300 Rip rap and rock lining, dumped, 50 lb. average.
Hydroseeding (Grass) of Disturbed and Graded Areas	161	MSF	$57.40	$9,213	RS Means Heavy Construction Cost Data 2013, 32 92 19.14 4600 Seeding, slope mix, 6#/M.S.F., hydro- or air seeding, with mulch and fertilizer.
Dust Suppression	3.25	MO	$30,000.00	$97,500	One 4,000-gallon water truck spraying water for dust suppression during all phases of work. Includes operator costs.
After Action Report	1	LS	$20,000	$20,000.00	Includes 10 days for Technical Staff to write a completion report, including graphics, review, and production.
SUBTOTAL				**$1,109,021**	
Contingency	25%			$277,255	15% scope + 10% bid
SUBTOTAL				**$1,386,276**	
Project Management	10%			$110,902.06	Includes project management during all phases of construction, regulatory interface, permitting, and crew per diems.
Construction Management	12%			$133,082.47	Includes construction management, quality control, geotechnical testing, and quality control testing.
SUBTOTAL					
Institutional Controls	1	LS	$40,500	$40,500	Forest Plan amendment, legal description for ARIC, and legal fees. Includes reproduction.
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$1,670,760**	

Table D-4. Alternative 2B - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 2B (Excavation and Single Onsite Encapsulation Unit - Asphalt Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Inspections and Maintenance					
Biannual Inspections	2	LS	$ 2,000	$ 4,000	Biannual inspections to evaluate the integrity of all cover elements and stormwater BMPs.
Minor Repairs	1	LS	$ 8,000	$ 8,000	Replace erosion control fabric or other BMPs, and repair asphalt cover.
SUBTOTAL				**$12,000**	
Contingency	25%			$ 3,000	10% scope + 15% bid
SUBTOTAL				**$15,000**	
Project Management	10%			$1,200	
Contractor Overhead	7%			$840	
Profit	10%			$1,200	
		TOTAL ANNUAL O&M COSTS:		**$18,240**	per year
		TOTAL ANNUAL O&M COSTS:		**$547,200**	Years 1-30

PERIODIC COSTS	**Year**					
Five-Year Review Report	5	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 5.
Significant Repairs	5	1	LS	$17,500	$17,500.00	Costs for significant repairs and BMPs, crack sealing asphalt.
SUBTOTAL (YEAR 5)					**$36,500.00**	
Five-Year Review Report	10	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 10.
Major Repairs	10	1	LS	$30,000	$30,000.00	Costs for major repairs to asphalt.
SUBTOTAL (YEAR 10)					**$49,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 15.
Significant Repairs	15	1	LS	$17,500	$17,500.00	Costs for significant repairs and BMPs, crack sealing asphalt.
SUBTOTAL (YEAR 15)					**$36,500.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 20.
Major Repairs	20	1	LS	$30,000	$30,000.00	Costs for major repairs to asphalt.
SUBTOTAL (YEAR 20)					**$49,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 25.
Significant Repairs	15	1	LS	$17,500	$17,500.00	Costs for significant repairs and BMPs, crack sealing asphalt.
SUBTOTAL (YEAR 25)					**$36,500.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 30.
Major Repairs	20	1	LS	$30,000	$30,000.00	Costs for major repairs to asphalt.
SUBTOTAL (YEAR 30)					**$49,000.00**	

Table D-4. Alternative 2B - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 2B (Excavation and Single Onsite Encapsulation Unit - Asphalt Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)	PRESENT VALUE
Capital Cost	0	$ 1,670,760	$ 1,670,760	1.000	$ 1,670,760
Annual O&M Cost	1-30	$ 547,200	$18,240	0.747	$408,511.35
Periodic Cost	5	$36,500.00	$ 36,500	0.906	$ 33,059
Periodic Cost	10	$49,000.00	$ 49,000	0.820	$ 40,197
Periodic Cost	15	$36,500.00	$ 36,500	0.743	$ 27,120
Periodic Cost	20	$49,000.00	$ 49,000	0.673	$ 32,976
Periodic Cost	25	$36,500.00	$ 36,500	0.610	$ 22,248
Periodic Cost	30	$49,000.00	$ 49,000	0.552	$ 27,051
		$2,474,460			$2,261,923
TOTAL PRESENT VALUE OF SELECTED REMEDY				**$2,261,923**	

Notes:

1. Source: Office of Management and Budget, 2008. OMB Circular No. A-94. January. Online at: <http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html>.
2. Source: RS Means Heavy Construction Cost Data 2013
3. RS Means Costs were multiplied by a factor of 1.063 to account for a Eureka, CA localization factor. (p. 613)
4. Based on a 2.0 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2012)

BCY= bank cubic yard
BMPs = best management practices
cy = cubic yard
LS = lump sum
MO = month
MSF = 1000 square feet
O&M = operation and maintenance
RV = recreational vehicle
SF = square feet
SY = square yard
TN = ton

Table D-5. Alternative 2B - Cash Flow Analysis

Year	Periodic Cost	Annual Cost	Discount Factor	Actual Periodic Cost	Actual Annual Cost
1		$18,240	0.980392157		$17,882.35
2		$18,240	0.961168781		$17,531.72
3		$18,240	0.942322335		$17,187.96
4		$18,240	0.923845426		$16,850.94
5	$36,500	$18,240	0.90573081	$33,059.17	$16,520.53
6		$18,240	0.887971382		$16,196.60
7		$18,240	0.870560179		$15,879.02
8		$18,240	0.853490371		$15,567.66
9		$18,240	0.836755266		$15,262.42
10	$49,000	$18,240	0.8203483	$40,197.07	$14,963.15
11		$18,240	0.804263039		$14,669.76
12		$18,240	0.788493176		$14,382.12
13		$18,240	0.773032525		$14,100.11
14		$18,240	0.757875025		$13,823.64
15	$36,500	$18,240	0.74301473	$27,120.04	$13,552.59
16		$18,240	0.728445814		$13,286.85
17		$18,240	0.714162562		$13,026.33
18		$18,240	0.700159375		$12,770.91
19		$18,240	0.68643076		$12,520.50
20	$49,000	$18,240	0.672971333	$32,975.60	$12,275.00
21		$18,240	0.659775817		$12,034.31
22		$18,240	0.646839036		$11,798.34
23		$18,240	0.634155918		$11,567.00
24		$18,240	0.621721488		$11,340.20
25	$36,500	$18,240	0.609530871	$22,247.88	$11,117.84
26		$18,240	0.597579285		$10,899.85
27		$18,240	0.585862044		$10,686.12
28		$18,240	0.574374553		$10,476.59
29		$18,240	0.563112307		$10,271.17
30	$49,000	$18,240	0.552070889	$27,051.47	$10,069.77

Table D-6. Alternative 3A - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 3A (Excavation and Two Onsite Encapsulation Units - Soil Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Implementation Plans/Setup	1	LS	$25,000	$25,000.00	Includes 10 days for Technical Staff to complete pre-mobilization plans (including Work Plan and HASP with graphics, review, and production).
Design	1	LS	$87,500	$87,500.00	Includes 35 days for Technical Staff to complete the design of repository caps, geotechnical and chemical testing of import backfill, and excavation and creek bank restoration process. Includes surveys and plan to reduce risk of Port-Orford-cedar root disease.
Mobilization and demobilization	1	LS	$95,000	$95,000.00	Mobilization and demobilization of crew, materials, and equipment. Includes costs for sanitary facilities, storage facilities, air monitoring equipment and other project necessities. Craft trade crew of 10 plus 1 technical person for 4 days. Includes costs for RVs and level C PPE for the duration of work.
Site Work					
Creek Diversion	1	LS	$12,000.00	$12,000	Place temporary sandbags in the creek on the upstream side of the work area to divert creek water away from waste removal activities
Excavation of Contaminated Material	30,450	BCY	$2.43	$74,124	RS Means Heavy Construction Cost Data 2013, 31 23 16.42 0300. This assumes an excavator, hydraulic, crawler mtd., 3 cy capacity, and 2,080 cy/day. Price inflated $0.50 per cy for difficult excavation on slope.
Load and Haul Waste to Repository/Cap Area	30,450	BCY	$7.03	$213,955	RS Means Heavy Construction Cost Data 2013, G1030 140 3400. Load and haul common earth, 3.5 cy track loader, four 20 cy dump trailers, 1 mile roundtrip (weighted average, 1 mile is minimum distance).
Confirmation Sampling	1	LS	$4,500.00	$4,500	Assumes 2 days of Confirmation Sampling and XRF Rental.
Clean Cover Material Import	10,800	TN	$15.00	$162,000	Verbal quote from R. Brown Construction in Willow Creek, CA. Assumes site is accessible by truck.
Encapsulation of Repository and Mill Area Cap	6,750	BCY	$1.37	$9,256	RS Means Heavy Construction Cost Data 2013, 31 23 23.14 4020 Backfill, structural, 200 HP dozer, 50' haul, common earth + 31 23 23.23 5060 Compaction, riding, vibrating roller, 12" lifts, two passes.
Demarcation Fabric	90,750	SF	$0.20	$18,150	Install single layer Mirafi 140N at 1 ft depth during encapsulation.
Grading Disturbed Waste Removal Areas	14,500	SY	$0.21	$2,897.50	RS Means Heavy Construction Cost Data 2013, 31 22 16.10 3300 Finish Grading, slopes, gentle.
Erosion Control Fabric	24,585	SY	$2.19	$53,836	RS Means Heavy Construction Cost Data 2013, 31 25 14.16 0020 Rolled erosion control mats and blankets, jute mesh, 100 sy per roll, 4' wide, stapled.
Straw Wattle	14,870	LF	$1.20	$17,844	Install wattle along slopes of encapsulated and restored areas, placed along 15ft contours.
Rip Rap at Bottom of Creek Bank	10	TN	$35.61	$356	RS Means Heavy Construction Cost Data 2013, 31 37 13.10 0300 Rip rap and rock lining, dumped, 50 lb average.
Hydroseeding (Grass) of Disturbed and Graded Areas	221	MSF	$57.40	$12,700	RS Means Heavy Construction Cost Data 2013, 32 92 19.14 4600 Seeding, slope mix, 6#/M.S.F., hydro or air seeding, with mulch and fertilizer.
Dust Suppression	3	MO	$30,000.00	$90,000	One 4,000-gallon water truck spraying water for dust suppression during all phases of work. Includes operator costs.
After Action Report	1	LS	$20,000	$20,000.00	Includes 10 Days for Technical Staff to write a completion report, including graphics, review, and production.
SUBTOTAL				**$899,118**	
Contingency	25%			$224,779	15% scope + 10% bid
SUBTOTAL				**$1,123,897**	
Project Management	10%			$89,911.79	Includes project management during all phases of construction, regulatory interface, permitting, and crew per diems.
Construction Management	12%			$107,894.15	Includes construction management, quality control, geotechnical testing, and quality control testing.
SUBTOTAL					
Institutional Controls	1	LS	$40,500	$40,500	Forest Plan amendment, legal description for ARIC, and legal fees. Includes reproduction.
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$1,362,203**	

Table D-6. Alternative 3A - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 3A (Excavation and Two Onsite Encapsulation Units - Soil Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Inspections and Maintenance					
Biannual Inspections	2	LS	$ 2,000	$ 4,000	Biannual inspections to evaluate the integrity of all cover elements and stormwater BMPs.
Minor Repairs	1	LS	$ 8,500	$ 8,500	Replace erosion control fabric or other BMPs.
SUBTOTAL				**$12,500**	
Contingency	25%			$ 3,125	10% scope + 15% bid
SUBTOTAL				**$15,625**	
Project Management	10%			$1,250	
Contractor Overhead	7%			$875	
Profit	10%			$1,250	
		TOTAL ANNUAL O&M COSTS:		**$19,000**	per year
		TOTAL ANNUAL O&M COSTS:		**$570,000**	Years 1-30

PERIODIC COSTS	Year					
Five-Year Review Report	5	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 5.
Significant Repairs	5	1	LS	$20,000	$20,000.00	Costs for significant repairs and encapsulation BMPs.
SUBTOTAL (YEAR 5)					**$39,000.00**	
Five-Year Review Report	10	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 10.
Major Repairs	10	1	LS	$35,000	$35,000.00	Costs for major repairs to encapsulation.
SUBTOTAL (YEAR 10)					**$54,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 15.
Significant Repairs	15	1	LS	$20,000	$20,000.00	Costs for significant repairs and encapsulation BMPs.
SUBTOTAL (YEAR 15)					**$39,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 20.
Major Repairs	20	1	LS	$35,000	$35,000.00	Costs for major repairs to encapsulation.
SUBTOTAL (YEAR 20)					**$54,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 25.
Significant Repairs	15	1	LS	$20,000	$20,000.00	Costs for significant repairs and encapsulation BMPs.
SUBTOTAL (YEAR 25)					**$39,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 30.
Major Repairs	20	1	LS	$35,000	$35,000.00	Costs for major repairs to encapsulation.
SUBTOTAL (YEAR 30)					**$54,000.00**	

Table D-6. Alternative 3A - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 3A (Excavation and Two Onsite Encapsulation Units - Soil Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)	PRESENT VALUE
Capital Cost	0	$ 1,362,203	$ 1,362,203	1.000	$ 1,362,203
Annual O&M Cost	1-30	$ 570,000	$19,000	0.747	$425,532.66
Periodic Cost	5	$39,000.00	$ 39,000	0.906	$ 35,324
Periodic Cost	10	$54,000.00	$ 54,000	0.820	$ 44,299
Periodic Cost	15	$39,000.00	$ 39,000	0.743	$ 28,978
Periodic Cost	20	$54,000.00	$ 54,000	0.673	$ 36,340
Periodic Cost	25	$39,000.00	$ 39,000	0.610	$ 23,772
Periodic Cost	30	$54,000.00	$ 54,000	0.552	$ 29,812
		$2,211,203			$1,986,260

TOTAL PRESENT VALUE OF SELECTED REMEDY **$1,986,260**

Notes:

1. Source: Office of Management and Budget, 2008. OMB Circular No. A-94. January. Online at: <http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html>.
2. Source: RS Means Heavy Construction Cost Data 2013
3. RS Means Costs were multiplied by a factor of 1.063 to account for a Eureka, CA localization factor. (p. 613)
4. Based on a 2.0 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2012)

BCY= bank cubic yard
BMPs = best management practices
cy = cubic yard
LS = lump sum
MO = month
MSF = 1,000 square feet
O&M = operation and maintenance
PPE = personal protective equipment
RV = recreational vehicle
SF = square feet
SY = square yard
TN = ton

Table D-7. Alternative 3A - Cash Flow Analysis

Year	Periodic Cost	Annual Cost	Discount Factor	Actual Periodic Cost	Actual Annual Cost
1		$19,000	0.980392157		$18,627.45
2		$19,000	0.961168781		$18,262.21
3		$19,000	0.942322335		$17,904.12
4		$19,000	0.923845426		$17,553.06
5	$39,000	$19,000	0.90573081	$35,323.50	$17,208.89
6		$19,000	0.887971382		$16,871.46
7		$19,000	0.870560179		$16,540.64
8		$19,000	0.853490371		$16,216.32
9		$19,000	0.836755266		$15,898.35
10	$54,000	$19,000	0.8203483	$44,298.81	$15,586.62
11		$19,000	0.804263039		$15,281.00
12		$19,000	0.788493176		$14,981.37
13		$19,000	0.773032525		$14,687.62
14		$19,000	0.757875025		$14,399.63
15	$39,000	$19,000	0.74301473	$28,977.57	$14,117.28
16		$19,000	0.728445814		$13,840.47
17		$19,000	0.714162562		$13,569.09
18		$19,000	0.700159375		$13,303.03
19		$19,000	0.68643076		$13,042.18
20	$54,000	$19,000	0.672971333	$36,340.45	$12,786.46
21		$19,000	0.659775817		$12,535.74
22		$19,000	0.646839036		$12,289.94
23		$19,000	0.634155918		$12,048.96
24		$19,000	0.621721488		$11,812.71
25	$39,000	$19,000	0.609530871	$23,771.70	$11,581.09
26		$19,000	0.597579285		$11,354.01
27		$19,000	0.585862044		$11,131.38
28		$19,000	0.574374553		$10,913.12
29		$19,000	0.563112307		$10,699.13
30	$54,000	$19,000	0.552070889	$29,811.83	$10,489.35

Table D-8. Alternative 3B - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 3B (Excavation and Two Onsite Encapsulation Units - Asphalt Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Implementation Plans/Setup	1	LS	$25,000	$25,000.00	Includes 10 days for Technical Staff to complete pre-mobilization plans (including Work Plan and HASP with graphics, review, and production).
Design	1	LS	$87,500	$87,500.00	Includes 35 days for Technical Staff to complete the design of repository caps and excavation and creek bank restoration process. Includes surveys and plan to reduce risk of Port-Orford-cedar root disease.
Mobilization and demobilization	1	LS	$90,000	$90,000.00	Mobilization and demobilization of crew, materials, and equipment. Includes costs for sanitary facilities, storage facilities, air monitoring equipment and other project necessities. Craft trade crew of 10 plus 1 technical person for 4 days. Includes costs for RVs and level C PPE for the duration of work.
Site Work					
Creek Diversion	1	LS	$12,000.00	$12,000	Place temporary sandbags in the creek on the upstream side of the work area to divert creek water away from waste removal activities
Excavation of Contaminated Material	30,450	BCY	$2.43	$74,124	RS Means Heavy Construction Cost Data 2013, 31 23 16.42 0300. This assumes an excavator, hydraulic, crawler mtd., 3 cy capacity, and 2,080 cy/day. Price inflated $0.50 per cy for difficult excavation on slope.
Load and Haul Waste to Repository/Cap Area	30,450	BCY	$7.03	$213,955	RS Means Heavy Construction Cost Data 2013, G1030 140 3400. Load and haul common earth, 3.5 cy track loader, four 20 cy dump trailers, 1 mile roundtrip (weighted average, 1 mile is minimum distance).
Grading Repository and Cap Areas	10,100	SY	$0.21	$2,147	RS Means Heavy Construction Cost Data 2013, 31 22 16.10 3300 Finish Grading, slopes, gentle.
Confirmation Sampling	1	LS	$4,500.00	$4,500	Assumes 2 days of Confirmation Sampling and XRF Rental.
Demarcation Fabric	90,750	SF	$0.20	$18,150	Install single layer Mirafi 140N between waste and asphalt cap.
Asphalt Cap	90,750	SF	$4.62	$419,265	Verbal quote from Mercer Fraser, Willow Creek, CA. 6" base, 2" binder, 4" top installed.
Grading Disturbed Waste Removal Areas	14,500	SY	$0.21	$2,897.50	RS Means Heavy Construction Cost Data 2013, 31 22 16.10 3300 Finish Grading, slopes, gentle.
Erosion Control Fabric	14,500	SY	$2.19	$31,752	RS Means Heavy Construction Cost Data 2013, 31 25 14.16 0020 Rolled erosion control mats and blankets, jute mesh, 100 sy per roll, 4' wide, stapled.
Straw Wattle	8,700	LF	$1.20	$10,440	Install wattle along slopes of restored areas, placed along 15ft contours.
Rip Rap at Bottom of Creek Bank	10	TN	$35.61	$356	RS Means Heavy Construction Cost Data 2013, 31 37 13.10 0300 Rip rap and rock lining, dumped, 50 lb average.
Hydroseeding (Grass) of Disturbed and Graded Areas	131	MSF	$57.40	$7,491	RS Means Heavy Construction Cost Data 2013, 32 92 19.14 4600 Seeding, slope mix, 6#/M.S.F., hydro or air seeding, with mulch and fertilizer.
Dust Suppression	2.5	MO	$30,000.00	$75,000	One 4,000-gallon water truck spraying water for dust suppression during all phases of work. Includes operator costs.
After Action Report	1	LS	$20,000	$20,000.00	Includes 10 Days for Technical Staff to write a completion report, including graphics, review, and production.
SUBTOTAL				**$1,094,577**	
Contingency	25%			$273,644	15% scope + 10% bid
SUBTOTAL				**$1,368,221**	
Project Management	10%			$109,457.69	Includes project management during all phases of construction, regulatory interface, permitting, and crew per diems.
Construction Management	12%			$131,349.23	Includes construction management, quality control, geotechnical testing, and quality control testing.
SUBTOTAL					
Institutional Controls	1	LS	$40,500	$40,500	Forest Plan amendment, legal description for ARIC, and legal fees. Includes reproduction.
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$1,649,528**	

Table D-8. Alternative 3B - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 3B (Excavation and Two Onsite Encapsulation Units - Asphalt Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Inspections and Maintenance					
Biannual Inspections	2	LS	$ 2,000	$ 4,000	Biannual inspections to evaluate the integrity of all cover elements and stormwater BMPs.
Minor Repairs	1	LS	$ 9,500	$ 9,500	Replace erosion control fabric or other BMPs, and repair asphalt.
SUBTOTAL				**$13,500**	
Contingency	25%			$ 3,375	10% scope + 15% bid
SUBTOTAL				**$16,875**	
Project Management	10%			$1,350	
Contractor Overhead	7%			$945	
Profit	10%			$1,350	
		TOTAL ANNUAL O&M COSTS:		**$20,520**	per year
		TOTAL ANNUAL O&M COSTS:		**$615,600**	Years 1-30

PERIODIC COSTS	Year					
Five-Year Review Report	5	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 5.
Significant Repairs	5	1	LS	$24,000	$24,000.00	Costs for significant repairs and BMPs, crack sealing asphalt.
SUBTOTAL (YEAR 5)					**$43,000.00**	
Five-Year Review Report	10	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 10.
Major Repairs	10	1	LS	$42,000	$42,000.00	Costs for major repairs to asphalt.
SUBTOTAL (YEAR 10)					**$61,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 15.
Significant Repairs	15	1	LS	$24,000	$24,000.00	Costs for significant repairs and BMPs, crack sealing asphalt.
SUBTOTAL (YEAR 15)					**$43,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 20.
Major Repairs	20	1	LS	$42,000	$42,000.00	Costs for major repairs to asphalt.
SUBTOTAL (YEAR 20)					**$61,000.00**	
Five-Year Review Report	15	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 25.
Significant Repairs	15	1	LS	$24,000	$24,000.00	Costs for significant repairs and BMPs, crack sealing asphalt.
SUBTOTAL (YEAR 25)					**$43,000.00**	
Five-Year Review Report	20	1	LS	$19,000	$19,000.00	Preparation of one report at the end of Year 30.
Major Repairs	20	1	LS	$42,000	$42,000.00	Costs for major repairs to asphalt.
SUBTOTAL (YEAR 30)					**$61,000.00**	

Table D-8. Alternative 3B - Cost Summary

Site: Horse Mountain Mine and Mill Site

Description: Alternative 3B (Excavation and Two Onsite Encapsulation Units - Asphalt Cover)
Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

Location: Six Rivers National Forest, Humboldt County, California

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)	PRESENT VALUE
Capital Cost	0	$ 1,649,528	$ 1,649,528	1.000	$ 1,649,528
Annual O&M Cost	1-30	$ 615,600	$20,520	0.747	$459,575.27
Periodic Cost	5	$43,000.00	$ 43,000	0.906	$ 38,946
Periodic Cost	10	$61,000.00	$ 61,000	0.820	$ 50,041
Periodic Cost	15	$43,000.00	$ 43,000	0.743	$ 31,950
Periodic Cost	20	$61,000.00	$ 61,000	0.673	$ 41,051
Periodic Cost	25	$43,000.00	$ 43,000	0.610	$ 26,210
Periodic Cost	30	$61,000.00	$ 61,000	0.552	$ 33,676
		$2,577,128			$2,330,978

TOTAL PRESENT VALUE OF SELECTED REMEDY **$2,330,978**

Notes:

1. Source: Office of Management and Budget, 2008. OMB Circular No. A-94. January. Online at: <http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html>.
2. Source: RS Means Heavy Construction Cost Data 2013
3. RS Means Costs were multiplied by a factor of 1.063 to account for a Eureka, CA localization factor. (p. 613)
4. Based on a 2.0 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2012)

BCY= bank cubic yard
BMPs = best management practices
cy = cubic yard
LS = lump sum
MO = month
MSF = 1,000 square feet
O&M = operation and maintenance
PPE = personal protective equipment
RV = recreational vehicle
SF = square feet
SY = square yard
TN = ton

Table D-9. Alternative 3B - Cash Flow Analysis

Year	Periodic Cost	Annual Cost	Discount Factor	Actual Periodic Cost	Actual Annual Cost
1		$20,520	0.980392157		$20,117.65
2		$20,520	0.961168781		$19,723.18
3		$20,520	0.942322335		$19,336.45
4		$20,520	0.923845426		$18,957.31
5	$43,000	$20,520	0.90573081	$38,946.42	$18,585.60
6		$20,520	0.887971382		$18,221.17
7		$20,520	0.870560179		$17,863.89
8		$20,520	0.853490371		$17,513.62
9		$20,520	0.836755266		$17,170.22
10	$61,000	$20,520	0.8203483	$50,041.25	$16,833.55
11		$20,520	0.804263039		$16,503.48
12		$20,520	0.788493176		$16,179.88
13		$20,520	0.773032525		$15,862.63
14		$20,520	0.757875025		$15,551.60
15	$43,000	$20,520	0.74301473	$31,949.63	$15,246.66
16		$20,520	0.728445814		$14,947.71
17		$20,520	0.714162562		$14,654.62
18		$20,520	0.700159375		$14,367.27
19		$20,520	0.68643076		$14,085.56
20	$61,000	$20,520	0.672971333	$41,051.25	$13,809.37
21		$20,520	0.659775817		$13,538.60
22		$20,520	0.646839036		$13,273.14
23		$20,520	0.634155918		$13,012.88
24		$20,520	0.621721488		$12,757.72
25	$43,000	$20,520	0.609530871	$26,209.83	$12,507.57
26		$20,520	0.597579285		$12,262.33
27		$20,520	0.585862044		$12,021.89
28		$20,520	0.574374553		$11,786.17
29		$20,520	0.563112307		$11,555.06
30	$61,000	$20,520	0.552070889	$33,676.32	$11,328.49

Table D-10. Alternative 4 - Cost Summary

Site: Horse Mountain Mine and Mill Site

Location: Six Rivers National Forest, Humboldt County, California

Description: Alternative 4 (Excavation and Off-site Disposal) Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Implementation Plans/Setup	1	LS	$25,000	$25,000.00	Includes 10 days for Technical Staff to complete pre-mobilization plans (including Work Plan and HASP with graphics, review, and production).
Design	1	LS	$37,500	$37,500.00	Includes 15 days for Technical Staff to complete the design of excavation and creek bank restoration process. Includes surveys and plant to reduce risk from Port-Orford-cedar root disease.
Mobilization and demobilization	1	LS	$160,000	$160,000.00	Mobilization and demobilization of crew, materials, and equipment. Includes costs for sanitary facilities, storage facilities, air monitoring equipment, and other project necessities. Craft trade crew of 10 plus 1 technical person for 4 days. Includes costs for RVs and level C PPE for the duration of work.
Site Work					
Road Grading	1	LS	$7,000.00	$7,000	Light road grading for haul truck access. Assumes 1 day of work, and includes use of a skidsteer, dozer, and backhoe.
Mill Foundation Demolition	1	LS	$85,000.00	$85,000	Assumes demolition of concrete foundation using 1 excavator, 1 backhoe with breaker, and 1 loader.
Creek Diversion	1	LS	$12,000.00	$12,000	Place temporary sandbags in the creek on the upstream side of the work area to divert creek water away from waste removal activities
Excavation and Loading of Contaminated Material	31,500	BCY	$2.92	$92,015	RS Means Heavy Construction Cost Data 2013, 31 23 16.42 0300. This assumes an excavator, hydraulic, crawler mtd., 3 cy capacity, and 2,080 cy/day. Price inflated $0.50 per cy for difficult excavation on slope. Add 20% for loading into offhaul trucks.
Offsite Disposal	50,400	TN	$90.60	$4,566,240	Quote from Denbeste. Transport to Hay Road Landfill in Vacaville, CA as Bevill exempt mine waste/mine tailings.
Confirmation Sampling	1	LS	$4,500.00	$4,500	Assumes 2 days of Confirmation Sampling and XRF Rental.
Grading Disturbed Waste Removal Areas	17,835	SY	$0.21	$3,792	RS Means Heavy Construction Cost Data 2013, 31 22 16.10 3300 Finish Grading, slopes, gentle.
Erosion Control Fabric	17,835	SY	$2.19	$39,055	RS Means Heavy Construction Cost Data 2013, 31 25 14.16 0020 Rolled erosion control mats and blankets, jute mesh, 100 sy per roll, 4' wide, stapled.
Straw Wattle	10,700	LF	$1.20	$12,840	Install wattle along slopes of restored areas, placed along 15-foot contours.
Rip Rap at Bottom of Creek Bank	10	TN	$35.61	$356	RS Means Heavy Construction Cost Data 2013, 31 37 13.10 0300 Riprap and rock lining, dumped, 50 lb. average.
Hydroseeding (Grass) of Disturbed and Graded Areas	160	MSF	$57.40	$9,184	RS Means Heavy Construction Cost Data 2013, 32 92 19.14 4600 Seeding, slope mix, 6#/M.S.F., hydro- or air seeding, with mulch and fertilizer.
Dust Suppression	9.25	MO	$30,000.00	$277,500	One 4,000-gallon water truck spraying water for dust suppression during all phases of work. Includes operator costs.
After Action Report	1	LS	$20,000	$20,000	Includes 10 days for Technical Staff to write a completion report, including graphics, review, and production.
SUBTOTAL				**$5,351,982**	
Contingency	25%			$1,337,996	15% scope + 10% bid
SUBTOTAL				**$6,689,978**	
Project Management	10%			$535,198.23	Includes project management during all phases of construction, regulatory interface, permitting, and crew per diems.
Construction Management	12%			$642,237.87	Includes construction management, quality control, geotechnical testing, and quality control testing.
SUBTOTAL					
Institutional Controls	1	LS	$40,500	$40,500	Forest Plan amendment, legal description for ARIC, and legal fees. Includes reproduction.
	TOTAL CAPITAL CONSTRUCTION COSTS:			**$7,907,914**	

Table D-10. Alternative 4 - Cost Summary

Site: Horse Mountain Mine and Mill Site

Location: Six Rivers National Forest, Humboldt County, California

Description: Alternative 4 (Excavation and Off-site Disposal) Cost Summary for the Horse Mountain Mine and Mill Site EE/CA

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	SOURCE/NOTES
Inspections and Maintenance					
Biannual Inspections	2	LS	$ 2,000	$ 4,000	Biannual inspections to evaluate the integrity of all graded areas and stormwater BMPs.
Minor Repairs	1	LS	$ 3,500	$ 3,500	Replace erosion control fabric or other BMPs.
SUBTOTAL				**$7,500**	
Contingency	25%			$ 1,875	10% scope + 15% bid
SUBTOTAL				**$9,375**	
Project Management	10%			$750	
Contractor Overhead	7%			$525	
Profit	10%			$750	
			TOTAL ANNUAL O&M COSTS:	**$11,400**	per year
			TOTAL ANNUAL O&M COSTS:	**$11,400**	Year 1 only

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR (2.0%)	PRESENT VALUE
Capital Cost	0	$ 7,907,914	$ 7,907,914	1.000	$ 7,907,914
Annual O&M Cost	1-30	$11,400	$11,400	0.747	$11,176.47
		$7,919,314			$7,919,090
TOTAL PRESENT VALUE OF SELECTED REMEDY				**$7,919,090**	

Notes:

1. Source: Office of Management and Budget, 2008. OMB Circular No. A-94. January. Online at: <http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html>.
2. Source: RS Means Heavy Construction Cost Data 2013
3. RS Means Costs were multiplied by a factor of 1.063 to account for a Eureka, CA localization factor. (p. 613)
4. Based on a 2.0 percent discount factor for projects with a 30-year (or greater) duration, as specified for federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective December 2012)

BCY= bank cubic yard

BMPs = best management practices

cy = cubic yard

LS = lump sum

MO = month

MSF = 1,000 square feet

O&M = operation and maintenance

PPE = personal protective equipment

RV = recreational vehicle

SF = square feet

SY = square yard

TN = ton

Table D-11. Alternative 4 - Cash Flow Analysis

Year	Periodic Cost	Annual Cost	Discount Factor	Actual Periodic Cost	Actual Annual Cost
1		$11,400	0.980392157		$11,176.47
2		$0	0.961168781		$0.00
3		$0	0.942322335		$0.00
4		$0	0.923845426		$0.00
5		$0	0.90573081		$0.00
6		$0	0.887971382		$0.00
7		$0	0.870560179		$0.00
8		$0	0.853490371		$0.00
9		$0	0.836755266		$0.00
10		$0	0.8203483		$0.00
11		$0	0.804263039		$0.00
12		$0	0.788493176		$0.00
13		$0	0.773032525		$0.00
14		$0	0.757875025		$0.00
15		$0	0.74301473		$0.00
16		$0	0.728445814		$0.00
17		$0	0.714162562		$0.00
18		$0	0.700159375		$0.00
19		$0	0.68643076		$0.00
20		$0	0.672971333		$0.00
21		$0	0.659775817		$0.00
22		$0	0.646839036		$0.00
23		$0	0.634155918		$0.00
24		$0	0.621721488		$0.00
25		$0	0.609530871		$0.00
26		$0	0.597579285		$0.00
27		$0	0.585862044		$0.00
28		$0	0.574374553		$0.00
29		$0	0.563112307		$0.00
30		$0	0.552070889		$0.00

Attachment 1. PA/SI Sample Results

Table 3-1: Solid-Matrix Analyses

METHOD & ANALYTES	Action Levels Primary HRS	TTLC	PRGr	PRGi	BLM	sample	HM-SS-1	HM-TL-2	HM-TL-3	HM-TL-4	HM-TL-5	HM-TL-6	HM-TL-7	HM-TL-8	HM-TL-9	HM-TL-10	HM-TL-11	HM-SS-12	HM-SS-13
			Secondary			matrix	soil	tailings	tailings	tailings	tailings	tailings	tailings	tailings	tailings	tailings	tailings	tailings	tailings
						location	bkgd	Adit/Pond	Adit/Pond	Mill	Mill	Mill	Mill	Mill	Mill	Mill	Mill	Adit/Pond	Open Pit
	All	Soil mg/kg	Soil mg/kg	Soil mg/kg	Soil mg/kg	latitude	40.86605	40.85960	40.85990	40.85852	40.85868	-	40.85810	40.85862	40.85870	40.85868	40.85865	40.85958	40.86657
						longitude	123.73418	123.72020	123.71988	123.71493	123.71453	-	123.71583	123.71563	123.71575	123.71565	123.71552	123.71993	123.72795
Metals by EPA Method 6010/7000																			
Antimony	3x Bkgd	15	31	409	50		9.88	10.5	8.8	11.7	10.9	18.4	16.4	11.8	18.8	8.36	15.8	19.7	25.2
Arsenic	3x Bkgd	500	0.39	2	20		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Barium	3x Bkgd	10,000	5,375	66,577	-		1.98	4.66	1.97	**6.79**	3.07	**17.4**	**14**	**7**	**7.87**	**6.62**	**18.1**	5.38	1.46
Beryllium	3x Bkgd	75	154	1,941	-		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	3x Bkgd	100	37	451	70		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.33	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	3x Bkgd	2,500	211	448	-		556	602	604	751	744	1180	917	918	1180	787	941	1050	688
Cobalt	3x Bkgd	8,000	903	1,921	-		72.8	54.1	71.3	89.3	71.3	123	70.9	54.3	96.6	52.1	80.5	69.8	70.9
Copper	3x Bkgd	2,500	3,129	40,877	5,000		4.07	7.71	5.26	**1640**	**1800**	**29.1**	**314**	**8060**	**103**	**16500**	**14500**	**30.9**	**151**
Lead	3x Bkgd	1,000	400	800	1,000		<0.5	**11.3**	**6.1**	**6.35**	<0.5	<0.5	**35.9**	**2.25**	<0.5	**10**	**22.9**	**23.7**	**4480**
Molybdenum	3x Bkgd	-	-	-	-		1.73	1.15	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.17	<1
Nickel	3x Bkgd	2,000	1,564	20,439	2,700		1560	1190	1360	1450	1490	2030	1300	705	1630	703	1050	1480	1400
Selenium	3x Bkgd	100	391	5,110	700		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Silver	3x Bkgd	500	391	5,110	700		<0.5	<0.5	<0.5	**0.785**	<0.5	<0.5	<0.5	**0.725**	<0.5	**1.55**	**1.45**	**2.36**	<0.5
Thallium	3x Bkgd	700	5	67	<1		<1	<1	<1	<1	<1	<1	<1	1.2	<1	<1	<1	<1	<1
Vanadium	3x Bkgd	2,400	-	-	-		7.52	14.9	13.3	**29.4**	**26.2**	**50.8**	**36**	**36.5**	**38.2**	**30.1**	**38.4**	**27.6**	17.2
Zinc	3x Bkgd	5,000	23,463	100,000	40,000		11.4	21.7	15.2	**398**	14.5	25.6	16.1	28.2	20.1	**63.5**	**152**	29.3	9.34
Mercury	3x Bkgd	20	23	307	40		0.54	<0.14	<0.14	0.16	<0.14	<0.14	<0.14	<0.14	<0.14	0.27	0.16	0.9	<0.14
pH by EPA Method 7049							-	8.28	7.97	-	-	-	-	7.49	-	7.87	-	-	-
Synthetic Precipitate Leachate Procedure by EPA Method 1312	BLM Water ug/L	MCL Water ug/L	SQuIRTs Water ug/L				ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Antimony	124	6	88				-	53	<30	-	-	-	-	<30	-	<30	-	-	-
Arsenic	93	50	340				-	<5	<5	-	-	-	-	<5	-	<5	-	-	-
Barium	-	2,000	-				-	753	704	-	-	-	-	456	-	456	-	-	-
Beryllium	-	4	130				-	<5	<5	-	-	-	-	<5	-	<5	-	-	-
Cadmium	155	5	4				-	<5	<5	-	-	-	-	<5	-	<5	-	-	-
Chromium	-	100	-				-	139	<10	-	-	-	-	<10	-	<10	-	-	-
Cobalt	-	-	-				-	26	<5	-	-	-	-	<5	-	<5	-	-	-
Copper	11,490	1,300	18				-	28	26	-	-	-	-	21	-	56	-	-	-
Lead	50	15	83				-	<5	<5	-	-	-	-	<5	-	<5	-	-	-
Molymbdenum	-	-	-				-	14	<10	-	-	-	-	<10	-	<10	-	-	-
Nickel	6,194	100	1,400				-	**578**	<15	-	-	-	-	18	-	31	-	-	-
Selenium	1,548	50	186				-	<5	<5	-	-	-	-	<5	-	<5	-	-	-
Silver	1,548	100	4				-	<5	<5	-	-	-	-	<5	-	<5	-	-	-
Thallium	-	2	1,400				-	<5	<5	-	-	-	-	<5	-	<5	-	-	-
Vanadium	-	-	-				-	<5	<5	-	-	-	-	<5	-	<5	-	-	-
Zinc	92,909	5,000	120				-	191	174	-	-	-	-	107	-	122	-	-	-
Mercury	93	2	2				-	<1	<1	-	-	-	-	<1	-	<1	-	-	-
Total Petroleum Hydrocarbons By EPA Method 8015							mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
C06-C10			-				-	-	-	-	-	-	-	<3	-	4.4	-	-	-
C10-C22			-				-	-	-	-	-	-	-	<3	-	10	-	-	-
C22-C36			-				-	-	-	-	-	-	-	<5	-	255	-	-	-
Chrysotile							-	-	-	-	-	-	-	-	5.4%	-	-	<0.1%	31.3%

See next page for Table Notes

Table 3-1: Solid Matrix Analyses (continued)

METHOD & ANALYTES	Action Levels			sample	HM-SD-14	HM-SD-15	HM-SD-16	HM-SD-17	HM-SD-18
	Primary	Secondary		type	sediment	sediment	sediment	sediment	sediment
	HRS	SQuIRTs	BLM	location	Horse Mt.	Horse Mt.	unnamed	unnamed	unnamed
	All	Sed	Sed	latitude	40.8634500	40.8628500	40.8631833	40.8611000	40.8601667
		mg/kg	mg/kg	longitude	123.7122833	123.7115167	123.7125333	123.7148833	123.7193833
Metals by EPA Method 6010/7000					**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
Antimony	3x Bkgd	-	62		8.78	13.5	11.7	13.4	10.7
Arsenic	3x Bkgd	7.2	46		<1	<1	<1	<1	<1
Barium	3x Bkgd	-	-		4.17	5.07	6.69	5,77	4.1
Beryllium	3x Bkgd	-	-		<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium	3x Bkgd	0.676	155		<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	3x Bkgd	52.3	-		577	844	732	789	603
Cobalt	3x Bkgd	-	-		45.7	51.7	50.1	55.6	42.6
Copper	3x Bkgd	18.7	5,745		41.4	27.3	57.6	108	116
Lead	3x Bkgd	30.24	1,000		<0.5	<0.5	<0.5	<0.5	<0.5
Molybdemum	3x Bkgd	-	-		<1	<1	<1	<1	<1
Nickel	3x Bkgd	15.9	3,094		1080	1210	1140	1000	766
Selenium	3x Bkgd	-	774		<1	<1	<1	<1	<1
Silver	3x Bkgd	7.3	774		<0.5	<0.5	<0.5	<0.5	<0.5
Thallium	3x Bkgd	-	-		<1	<1	<1	<1	<1
Vanadium	3x Bkgd	-	-		20.8	41.4	31.4	38.8	23.8
Zinc	3x Bkgd	124	46,455		9.48	11.5	14.2	10.8	9.72
Mercury	3x Bkgd		46		<0.14	<0.14	<0.14	<0.14	<0.14
pH					8.21	8.81	8.37	8.64	8.21

Notes for Table 3-1

Action Levels:

HRS - Hazard Ranking System action level is three times background (3xbackground) for analytes that are detected in background

SQuiRTs - NOAA Screening Quick-Reference Table guidance values for ecological risk factors.

BLM - Bureau of Land Management Human Risk Management Criteria for Campers guidance action levels

PRG - US EPA Region IX Preliminary Remediation Goals (i = industrial; r = residential) guidance values for soils

TTLC - State of California Title 22 Total Threshold Level Concentration - regulatory threshold for hazardous waste.

MCL - Maximum Contaminant Level - Federal regulatory threshold under the US Clean Water Act.

Units

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

Boldface = exceeds primary action level

Table 3-2: Water Matrix Analyses

METHOD & ANALYTES	Action Levels				sample	HM-SW-1	HM-SW-2	HM-SW-3	HM-SW-4	HM-SW-5
	Primary	Secondary			type	background	background	downgradient	downgradient	downgradient
	HRS	BLM	MCL	SQuIRTs	location	HM Creek	unnamed	pond	mill site	HM Creek
		Water	Water	Water	latitude	40.86345	40.85995	40.85972	40.85868	40.86285
		ug/L	ug/L	ug/L	longitude	123.71228	123.72093	123.72020	123.71488	123.71152
Metals by EPA Method 6010/7000						ug/L	ug/L	ug/L	ug/L	ug/L
Antimony	3x Bkgd	124	6	88		**37**	<20	<20	<20	<20
Arsenic	3x Bkgd	93	50	340		9	<5	6	<5	<5
Barium	3x Bkgd	-	2,000	-		<10	<10	10	<10	<10
Beryllium	3x Bkgd	-	4	130		<5	<5	<5	<5	<5
Cadmium	3x Bkgd	155	5	4		<5	<5	<5	<5	<5
Chromium	3x Bkgd	-	100	-		<10	12	<10	15	10
Cobalt	3x Bkgd	-	-	-		<5	<5	<5	<5	<5
Copper	3x Bkgd	11,490	1,300	18		<10	<10	<10	<10	<10
Lead	3x Bkgd	50	15	83		<5	5	<5	<5	<5
Molybdemum	3x Bkgd	-	-	-		<10	<10	<10	<10	<10
Nickel	3x Bkgd	6,194	100	1,400		22	32	<20	45	21
Selenium	3x Bkgd	1,548	50	186		<10	<10	<10	<10	<10
Silver	3x Bkgd	1,548	100	4		<5	<5	<5	<5	<5
Thallium	3x Bkgd	-	2	1,400		<5	<5	<5	<5	<5
Vanadium	3x Bkgd	-	-	-		<5	<5	<5	<5	<5
Zinc	3x Bkgd	92,909	5,000	120		22	26	29	32	23
Mercury	3x Bkgd	93	2	2		<0.4	<0.4	<0.4	<0.4	<0.4

Notes for Table 3-2

Action Levels:

HRS - Hazard Ranking System action level is three times background (3xbackground) for analytes that are detected in background

SQuiRTs - NOAA Screening Quick-Reference Table guidance values for ecological risk factors.

BLM - Bureau of Land Management Human Risk Management Criteria for Campers guidance action levels

MCL - Maximum Contaminant Level - Federal regulatory threshold under the US Clean Water Act.

Units

ug/L = micrograms per liter