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Report of Results: MVA13129

Investigation of Asbestos Fiber Release During Discharge of Remington Shotgun Shells

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02 March 2020

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Introduction

This report presents the results of a study of asbestos fiber release during discharge of vintage asbestos-containing Remington shotgun shotshells (shells). Seven (7) boxes of shells, with a total of one hundred five (105) shells, were delivered to MVA Scientific Consultants on 17 October 2019 via UPS and assigned the MVA laboratory identification numbers AE1386 through AE1392 (Figures 1 through 8). A currently-available box of Remington shells was purchased on 28 October 2019 for comparison to the vintage shells and for use during setup of the experiment. This sample was assigned MVA laboratory identification number AE1446. Sample numbers and descriptions of the shell types investigated are provided in Table 1. The lot number printed on box AE1389 is difficult to read; however a photograph is provided in Figure 3. The dram equivalent amount has been torn off of box AE1392; however, the shell is a Magnum style, so therefore is it assumed to carry no more than the 4½ dram listed for AE1389, a 3" long Magnum shell.

It was requested that components of the shells be analyzed for the presence of asbestos and that a study be performed to gain information about the concentration of asbestos in the air, if any, during the discharge of asbestos-containing shotgun shells. The experiment was performed on 29 October 2019. Peter Diaczuk, Ph.D., a certified firearms instructor and forensic science consultant with Pedico Research Institute, Waymart, PA oversaw handling and firing of the shotgun. Mr. Chris DePasquale, CIH, of Compass Environmental, Kennesaw, GA, collected air samples during the study with the assistance of Steven Compton, Ph.D., of MVA Scientific Consultants. Abatement contractors from Branch Environmental Inc., Watkinsville, GA assembled the chamber utilized during the experiments. Sample numbers for the air samples collected during the activities are shown in Table 2. Laboratory analyses for the study (including examination of shell components and of air samples) were performed in the MVA laboratory during the period of 17 October 2019 through 27 February 2020.

Sample Description (Shotgun Shell Basewads)

A standard shotgun shell consists of a metal base with a primer, propellant (gun powder), shot (projectile/s), a wad to separate the powder from the shot, and a plastic casing attached to the base and crimped at the opposite end to hold it all together [1]. The metal base or "head" may also contain a filler material referred to as the basewad in the 1966 patent assigned to the Remington Arms Company [2]. This report will refer to the wad separating the powder/propellant from the shot as the "powder wad" in order to avoid confusion with the basewad, shot wad (a plastic cup sometimes used to contain the shot), or overshot wad (sometimes placed over the shot before crimping the case) [3].

Methods

One shell from each box was selected at random for analysis. Each shell tested was carefully dissected using a stainless steel razor blade. Wad components (from basewads and powder wads) were examined visually and under an Olympus SZ40 stereomicroscope at magnifications from 7X to 40X. For each component tested, a portion of the material was transferred via forceps onto a microscope slide and mounted in Cargille refractive index liquids for analysis by polarized light microscopy (PLM) using an Olympus BHSP polarized light microscope with a magnification range from 100X to 1,000X. The PLM analysis followed the analytical procedures recommended by the U.S. Environmental Protection Agency [4]. The PLM results for asbestos are given in terms of percent by volume.

During the experiments, airborne particles were collected with standard asbestos testing air filter cassettes. The air samples and two field blanks were analyzed using a combination of phase contrast microscopy (PCM) and transmission electron microscopy (TEM) asbestos testing methods, including one or more of the following: EPA AHERA method [5], ISO 10312-2019 method [6], NIOSH 7400 method [7], and NIOSH 7402 method [8]. TEM analyses were performed using either a Philips EM420 100 kV transmission electron microscope (TEM) capable of selected area electron diffraction (SAED) and equipped with a Thermo Scientific Noran System 7 energy dispersive spectrometry (EDS) x-ray analysis system or a Philips CM120 100 kV TEM capable of SAED and equipped with an Oxford INCA EDS system. TEM count sheets are provided in the Appendix.

Study Site

All studies were conducted in a specially built negative air enclosure (test chamber) in an open air basement located at a farm house in rural Farmington, GA. The test chamber work area was approximately 8 ft high by 14 ft wide by 15 ft long. The study area had a High Efficiency Particulate Absolute (HEPA) air filtration device which was used to maintain air flow within the chamber and to filter the air as it was removed from the chamber before, during, and after the experiments. The HEPA unit ran at a low flow rate (approximately 314 cubic feet per minute) during each of the experiments and a high flow rate (approximately 511 cubic feet per minute) between the experiments. While inside the study area between tests, Mr. DePasquale and Dr. Compton each wore a respirator and complete head and body protective suit. Shells were fired using a Remington 1100, 12 gauge, semi-automatic shotgun mounted onto a Lead Sled DFT 2 from Caldwell Shooting Supplies and equipped with a manual trigger pull (string) to allow for remote firing of the shotgun from outside the chamber. The shotgun was positioned to fire into a custom built target manufactured from ballistic rubber and steel to ensure that the shots were safely collected.

Five stationary air sampling pumps were utilized to collect air samples before and during the experiments. Four of the pumps were used to collect air samples at different locations within the study chamber, as shown in Figure 9. Air samples collected using Pump #01 were positioned within the breathing zone of a theoretical shooter (no shooter was present in the study chamber during firearm discharge), approximately 24” behind the shell ejector port. Air samples collected using Pump #02 were positioned 12” from the

muzzle exhaust (end of the barrel) and 36” downrange from the shell ejector port. Air samples collected using Pump #03 were positioned approximately 12” from the shell ejector port. Air samples collected using Pump #04 were set-up to replicate the position of a bystander standing three feet from the shooter. Air samples collected using Pump #05 were positioned outside of the containment within a few feet of the study chamber entry. After the experiments were conducted, the flow rate of Pump #03 had fallen outside of the acceptance range, so the results for those air samples are reported as a range based on the minimum and maximum flow rates recorded instead of an average flow rate.

The study was videotaped. During certain portions of the study, the lighting approximated Tyndall lighting and was used to improve the visibility of suspended particles in the air in the containment chamber. The light was placed outside the test chamber.

Study Design

Prior to the experiments with any asbestos-containing shells, three preliminary air samples were collected within the test chamber (in the vicinity of a shooter’s breathing zone). The first preliminary air sample was collected the day before the experiments were conducted by firing five modern shells (AE1446) over a period of fifteen minutes. The air sample was collected at a flow rate of 10.0 liters per minute (LPM). This air sample was visually determined to be overloaded with gunshot residue. On the morning of the experiment, one air sample was collected for a period of 15 minutes (at 10.0 liters per minute) without any shots fired. The flow rate of the pump was reduced to a flow rate of 5.07 LPM and a second air sample was collected over a fifteen minute period while firing two modern shells (AE1446). Visual loading of the filter appeared acceptable, so these parameters served as the parameters to be used for the experiments performed on three types of Remington shells.

The first experiment performed involved firing two shells from the Remington ShurShot style shell (AE1386). One shell was discharged at the beginning of the air sampling period and a second approximately halfway into the experiment. After the pumps were turned off, the flow rate for the HEPA unit was increased to purge the air for eight minutes and the air cassettes from Test A were recovered. After returning the HEPA unit back to a lower flow rate, an air sample was collected using Pump #01 to investigate the concentration of asbestos present in the air between Test A and Test B.

After this “between-test” air sample was collected, new air cassettes were prepared for Test B and the shotgun was loaded with two shells from the Remington Magnum Express style shell (AE1392). One shell was discharged at the beginning of the sampling period and the second discharged approximately 11 minutes into the experiment after manually loading the next shell into the chamber. After the pumps were turned off, the flow rate for the HEPA unit was increased to purge the air for six minutes and the air cassettes from Test B were recovered. After returning the HEPA unit back to a lower flow rate, an air sample was collected using Pump #01 to investigate the concentration of asbestos present in the air between Test B and Test C.

After this “between-test” air sample was collected, new air cassettes were prepared for Test C and the shotgun was loaded with two shells from the Remington Express style (AE1390). One shell was discharged at the beginning of the sampling period and the second discharged approximately halfway into the experiment. After the pumps were turned off, the flow rate for the HEPA unit was increased to purge the air for 10 minutes and the air cassettes from Test C were recovered. After returning the HEPA unit back to a lower flow rate, an air sample was collected using Pump #01 to investigate the concentration of asbestos present in the air between Test C and Test D.

After this “between-test” air sample was collected, new air cassettes were prepared for Test D and the shotgun was loaded with eight shells from the Remington Express style (AE1390). One shell was discharged at the beginning of the sampling period and at two minute intervals thereafter over a 16 minute sampling period.

Results and Discussion

Results of basewad analyses are summarized in Table 1. All seven vintage shell types analyzed contained a basewad constructed of a filler material (some combination of chrysotile asbestos and cellulose/wood fiber) and a waxy binder. The concentration of asbestos ranged from 10% to 15% on average. Asbestos was not detected in any of the powder wads. Filler materials for powder wads were composed primarily of cellulose. Photographs documenting the dissection of each shell and micrographs collected during examination of the basewads are provided in Figures 10 through 30.

Additional bulk analysis was performed on the basewad of a shell from set AE1390 after it was fired in the experiment. The fired shell shows some fracturing and spalling of the basewad, which demonstrates the effect of firing on the basewad. Gunshot residue was deposited in flakes, spheres and a partial coating, but unencapsulated chrysotile bundles were still visible. Photographs documenting the fracturing and spalling of the basewad are provided in Figures 31 and 32. The mass of recovered basewad material from an unfired AE1390 shell was measured at approximately 3.58 grams. The mass of recovered basewad material from a fired AE1390 shell was measured at approximately 3.52 grams, a difference of 0.06 grams; however, additional testing would be required to determine whether this mass difference is greater than any potential variability in mass from unfired basewads.

Still images taken from the video, provided in Figures 33 and 34, demonstrate the propagation of dust resulting from the discharge of the firearm and the ejection of the shell.

Results of NIOSH air sample analyses are summarized in Table 3. NIOSH 7400 concentrations from the breathing zone of a shooter (Pump #01) range from 0.11 to 0.23 fibers per cubic centimeter of air sampled (f/cc). These values represent concentrations from PCM analyses only and do not independently discriminate asbestos fibers from other fibers present in the air. Typically, a complementary analysis via TEM using NIOSH 7402 can be applied to establish an estimated asbestos f/cc concentration; however, in this study the NIOSH 7402 results were highly variable, with some samples indicating 0% asbestos and some indicating 100% asbestos. If the results of all air samples are combined, an average of 35% of the fibers identified by

TEM were consistent with asbestos, thus resulting in a breathing zone range of 0.04 to 0.08 asbestos f/cc. The variability in the 7402 results can be attributed to the presence of aluminum silicate fibers in the background air and non-fibrous gunshot residue (GSR). In addition, several asbestos fibers observed via TEM were not countable under NIOSH 7402 because they were below the minimum width cutoff of 0.25 micrometers.

Aluminum silicate fibers were detected in air samples both inside and outside the test chamber (i.e. Pump #05). A micrograph and spectrum of a representative aluminum silicate fiber bundle are provided in Figure 35. The detection in air samples from outside of the containment area indicates that these fibers were present in the ambient air and were not the result of experimental testing. For NIOSH 7402 analyses, these fibers were counted as “non-asbestos” fibers since they are inconsistent with the elemental composition of chrysotile fibers under investigation in this test.

Air samples from within the testing chamber for all four experiments also contained a background of very fine non-fibrous gunshot residue particulate. A micrograph and EDS spectrum of non-fibrous GSR near a chrysotile fiber bundle are provided in Figure 36. Samples from Test D had a higher level of background GSR, due to the increased number of shots, and it is possible that some fibers were obscured by heavily-loaded non-fibrous GSR and therefore not detected.

The NIOSH 7402 analysis is designed to serve as a correction factor to PCM fiber counts obtained using NIOSH 7400. The use of the method assumes that fibers thinner than 0.25 micrometers in width cannot be detected by PCM and therefore are not counted in the 7402 TEM method, even if they are detected. Therefore, in samples such as these where such fibers and fiber bundles are prevalent, the 7402 correction factor may not be the most accurate representation.

Because of these three issues, air samples from each experiment were also analyzed using either the EPA AHERA method or the ISO 10312 method, since both methods allow for a count of true asbestos fibers without a minimum width and without counting aluminum silicate fibers from the background air.

A summary of the AHERA/ISO 10312 TEM results is provided in Table 4. Chrysotile fibers and bundles were detected by TEM in chamber air samples in each of the four experiments. Micrographs and spectra of chrysotile fibers and bundles detected in the air samples are provided in Figures 37 through 40. Airborne asbestos structure concentrations for the shooter were 1.4 str/cc and 1.0 str/cc in the first and second tests, respectively. Prior to Test C, a residual concentration of 0.6 str/cc was detected, and an increased concentration of 2.5 str/cc was detected during Test C. Prior to Test D, a residual concentration of 0.37 str/cc was detected and an increased concentration of 1.98 str/cc was detected during Test D.

Because the “between-test” air samples are averages of an ever diminishing airborne concentration (due to the active purging of air from the negative air machine), it can be assumed that the actual concentration present in the air at the start of the subsequent test must be less than the average concentration reported for the “between-test” sample. It is therefore a conservative statement to say that the baseline-corrected breathing zone concentrations are 1.4, 1.0, 1.9, and 1.6 str/cc, respectively for each of

the four tests.

For a bystander, approximately three feet from the shooter, airborne asbestos concentrations were detected at levels of 0.3, 1.4, 1.3, and 0.25 str/cc. A similar conservative baseline-corrected approach as described above would suggest concentrations of 0.3, 1.4, 0.7, and <0.25 str/cc respectively.

Conclusions

Chrysotile fibers present in the basewad of vintage Remington shotgun shells make up approximately 10% to 15% (by volume) of the basewad material. Asbestos fibers from the basewad are aerosolized when the shell is discharged. Airborne asbestos fibers were detected in each of the four experiments conducted. Asbestos fiber structures present in the breathing zone of a shooter ranged from 1.0 to 2.5 str/cc (1.9 str/cc after baseline correction). For a bystander three feet from the shooter, the airborne asbestos concentration ranged from 0.25 to 1.4 str/cc. The range of fibers reported for the shooter via NIOSH 7400/7402 (fibers greater than 5 micrometers in length) is variable; however, it is estimated to be approximately 0.04 f/cc to 0.08 f/cc.

References

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8. National Institute of Occupational Safety and Health, NIOSH 7402, "Asbestos Fibers by Transmission Electron Microscopy (TEM)" - Method 7402 - NIOSH Manual of Analytical Methods, 4th Ed., U.S. Department of HHS, NIOSH Publ. 94-126, 1994.

Table 1. Remington 12 Gauge Shell Sample Information and Basewad PLM Analysis Results

MVA Sample ID	Description	PLM Analysis Results Chrysotile %
AE1386	Remington ShurShot, Power Piston, 3¼ Dram, 2¾", LOT LCL08H516	~10% (5-15%)
AE1387	Remington Shur Shot, New Plastic, Power Piston, "Kleanbore" Priming 3 Dram, 2¾", LOT BF26C5	~10% (5-15%)
AE1388	Remington Shur Shot, Power Piston, "Kleanbore" Priming 3 Dram, 2¾", LOT AG08A7DP	~10% (5-15%)
AE1389	Remington Magnum Express, Power Piston, "Kleanbore" Priming 4½ Dram, 3", LOT AT11P24(Smudged)	~15% (10-20%)
AE1390	Remington Express, Power Piston, "Kleanbore" Priming 3¾ Dram, 2¾", LOT BF22K6R	~15% (10-20%)
AE1391	Remington Express, Power Piston, "Kleanbore" Priming 3¾ Dram, 2¾", LOT AM21E4	~15% (10-20%)
AE1392	Remington Magnum Express, Power Piston, "Kleanbore" Priming ? Dram, 2¾", LOT AF18H2R	~10% (5-15%)
AE1446	Remington Express XLR 2¾", 1330 FPS, 1¼ oz.-6 Shot, LOT CO3JC504	No Asbestos Detected

Table 2. Remington Shell Discharge Experiments:
Summary of Air Samples Collected

MVA Sample #	Description	Volume (L)	Duration (Minutes)	Number and Type of Shots Discharged
AE1447	Test Discharge of Five Modern Shells	150	15	5 (AE1446) Non-Asbestos
AE1448	Background	150	15	0
AE1449	Test Discharge of Two Modern Shells	76	15	2 (AE1446) Non-Asbestos
AE1450	Test A, Pump 1	31	15	2 (AE1386) ShurShot
AE1451	Test A, Pump 2	30	15	
AE1452	Test A, Pump 3	34 - 42	15	
AE1453	Test A, Pump 4	43	15	
AE1454	Test A, Pump 5	76	15	0 (Outside Test Chamber)
AE1455	Between Tests A & B	31	15	0
AE1456	Test B, Pump 1	31	15	2 (AE1392) Magnum Express
AE1457	Test B, Pump 2	30	15	
AE1458	Test B, Pump 3	34 - 42	15	
AE1459	Test B, Pump 4	43	15	
AE1460	Test B, Pump 5	76	15	0 (Outside Test Chamber)
AE1461	Between Tests B & C	31	15	0
AE1462	Test C, Pump 1	31	15	2 (AE1390) Express
AE1463	Test C, Pump 2	30	15	
AE1464	Test C, Pump 3	34 - 42	15	
AE1465	Test C, Pump 4	43	15	
AE1466	Test C, Pump 5	76	15	0 (Outside Test Chamber)
AE1467	Between Tests C & D	31	15	0
AE1468	Test D, Pump 1	33	16	8 (AE1390) Express
AE1469	Test D, Pump 2	32	16	
AE1470	Test D, Pump 3	36 - 44	16	
AE1471	Test D, Pump 4	46	16	
AE1472	Test D, Pump 5	81	16	0 (Outside Test Chamber)
AE1473	Field Blank #1	N/A	N/A	N/A
AE1474	Field Blank #2	N/A	N/A	N/A

Table 3. Results of NIOSH Air Sample Analyses

MVA ID	Description	Duration Minutes	Volume Liters	7400 F/cc	7402 %Asb
AE1450	Test A, Pump 1	15	31	0.19	0%
AE1451	Test A, Pump 2	15	30	0.27	100%
AE1452	Test A, Pump 3	15	34 - 42	0.21 - 0.26	NA
AE1453	Test A, Pump 4	15	43	<LOD (0.06)	NA
AE1456	Test B, Pump 1	15	31	0.13	50%
AE1457	Test B, Pump 2	15	30	0.17	33%
AE1458	Test B, Pump 3	15	34 - 42	<LOD (0.06-0.08)	NA
AE1459	Test B, Pump 4	15	43	0.15	NA
AE1462	Test C, Pump 1	15	31	0.11	33%
AE1463	Test C, Pump 2	15	30	0.18	33%
AE1464	Test C, Pump 3	15	34 - 42	0.11 - 0.13	NA
AE1465	Test C, Pump 4	15	43	0.18	NA
AE1468	Test D, Pump 1	16	33	0.23†	33%
AE1469	Test D, Pump 2	16	32	0.31†	22%
AE1470	Test D, Pump 3	16	36 - 44	0.15 - 0.19†	NA
AE1471	Test D, Pump 4	16	46	0.19†	NA
AE1473	Field Blank #1	---	0	---	NSD
AE1474	Field Blank #2	---	0	---	NSD

NA – Not Analyzed
LOD – Limit of Detection
NSD – No (Asbestos) Structures Detected
†Heavily Loaded, Possible Underestimate

Table 4. Results of TEM Air Sample Analyses (AHERA/ISO 10312)

MVA ID	Description	Volume Liters	AHERA Str/cc	ISO Str/cc
AE1448	Background	150	NSD <0.006*	NA
AE1449	Test Discharge of Two Modern Shells	76	NSD <0.03*	NA
AE1450	Test A, Pump 1	31	1.4	NA
AE1451	Test A, Pump 2	30	1.3	NA
AE1452	Test A, Pump 3	34 - 42	0.4 - 0.5	NA
AE1453	Test A, Pump 4	43	0.3	NA
AE1454	Test A, Pump 5	76	NSD <0.05*	NA
AE1455	Between Tests A & B	31	NSD <0.1*	NA
AE1456	Test B, Pump 1	31	1.0	NA
AE1457	Test B, Pump 2	30	2.1	NA
AE1458	Test B, Pump 3	34 - 42	2.1 - 2.6	NA
AE1459	Test B, Pump 4	43	1.4	NA
AE1460	Test B, Pump 5	76	NSD <0.05*	NA
AE1461	Between Tests B & C	31	0.6	NA
AE1462	Test C, Pump 1	31	2.5	NA
AE1463	Test C, Pump 2	30	1.5	NA
AE1464	Test C, Pump 3	34 - 42	1.1 - 1.4	NA
AE1465	Test C, Pump 4	43	1.3	NA
AE1466	Test C, Pump 5	76	NSD <0.05*	NA
AE1467	Between Tests C & D	31	NA	0.37
AE1468	Test D, Pump 1	33	NA	1.98†
AE1469	Test D, Pump 2	32	NA	0.72†
AE1470	Test D, Pump 3	36 - 44	NA	0.70 - 0.86†
AE1471	Test D, Pump 4	46	NA	0.25†
AE1472	Test D, Pump 5	81	NA	NSD <0.05*
AE1473	Field Blank #1	0	NSD	NA
AE1474	Field Blank #2	0	NSD	NA

NSD – No (Asbestos) Structures Detected
NA – Not Analyzed
*Analytical Sensitivity
†Heavily Loaded, Possible Underestimate

(a) (b) (c)

(d) (e)

(f) (g)

Figure 1. Remington 12 gauge shotgun shells in boxes, as received, samples (a) AE1386, (b) AE1387, (c) AE1388, (d) AE1389, (e) AE1390, (f) AE1391, (g) AE1392.

(a) (b) (c)

(d) (e)

(f) (g)

Figure 2. Remington 12 gauge shotgun shells in boxes, as received, samples (a) AE1386, (b) AE1387, (c) AE1388, (d) AE1389, (e) AE1390, (f) AE1391, (g) AE1392.

(a) (b) (c)

(d) (e)

(f) (g)

Figure 3. Remington 12 gauge shotgun shells in boxes, as received, samples (a) AE1386, (b) AE1387, (c) AE1388, (d) AE1389, (e) AE1390, (f) AE1391, (g) AE1392.

(a) (b) (c)

(d) (e)

(f) (g)

Figure 4. Remington 12 gauge shotgun shells in boxes, as received, samples (a) AE1386, (b) AE1387, (c) AE1388, (d) AE1389, (e) AE1390, (f) AE1391, (g) AE1392.

(a) (b) (c)

(d) (e) (f) (g)

Figure 5. Remington 12 gauge shotgun shells in boxes, as received, samples (a) AE1386, (b) AE1387, (c) AE1388, (d) AE1389, (e) AE1390, (f) AE1391, (g) AE1392.

(a) (b) (c)

(d) (e)

(f) (g)

Figure 6. Remington 12 gauge shotgun shells in boxes, as received, samples (a) AE1386, (b) AE1387, (c) AE1388, (d) AE1389, (e) AE1390, (f) AE1391, (g) AE1392.

Figure 7. Remington 12 gauge shotgun shells, as received.

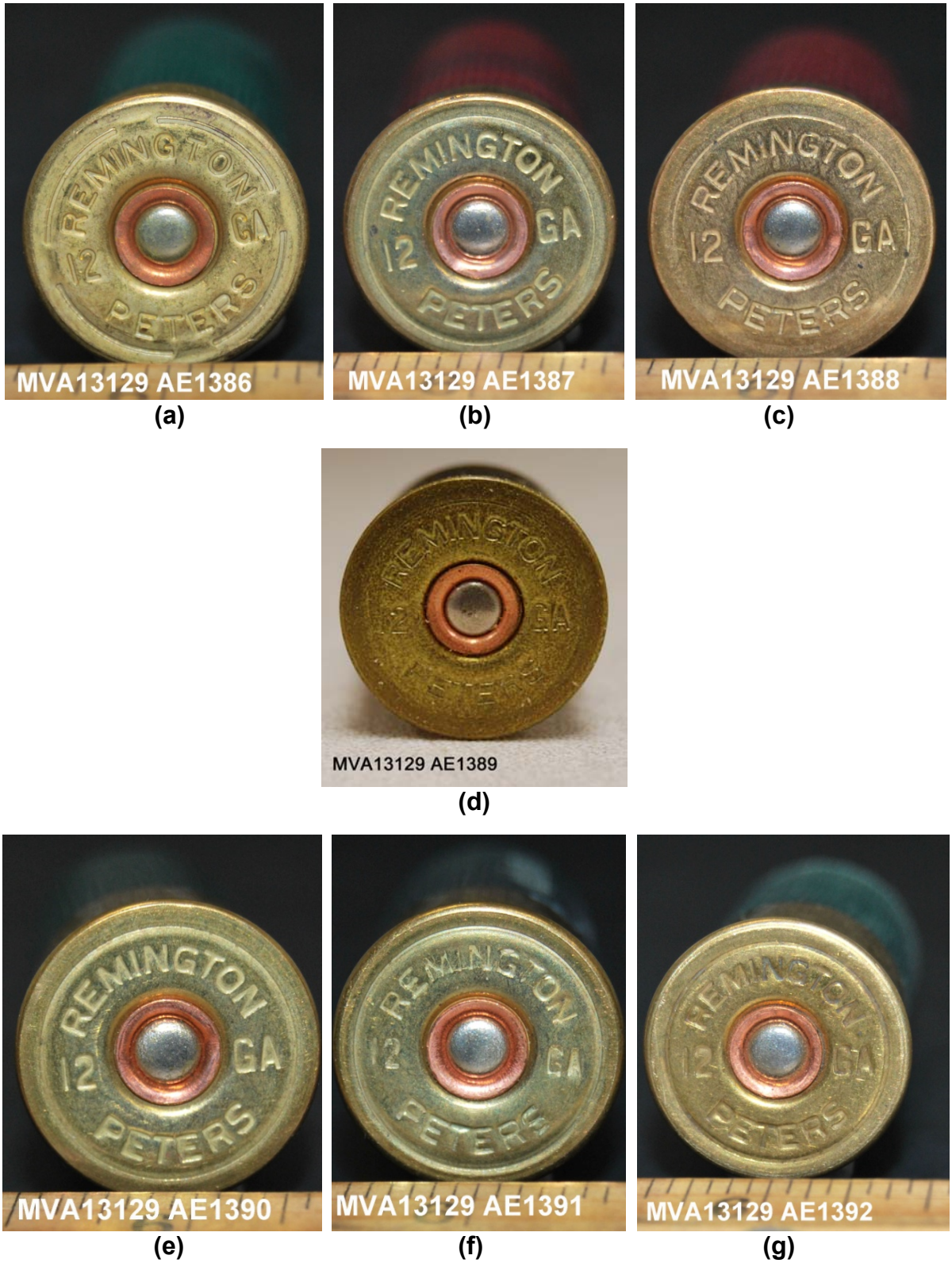

Figure 8. Representative photos of metal base and primer for each style of Remington 12 gauge shotgun shells, samples (a) AE1386, (b) AE1387, (c) AE1388, (d) AE1389, (e) AE1390, (f) AE1391, (g) AE1392. Photograph (d) of AE1389 taken under different lighting conditions. AE1389 metal base appears consistent with other shells when viewed side-by-side.

Figure 9. Still image extracted from video and annotated to illustrate the location of the air samples connected to Pumps #01 through #04. Air samples collected via Pump #05 were located outside of the containment area and not pictured.

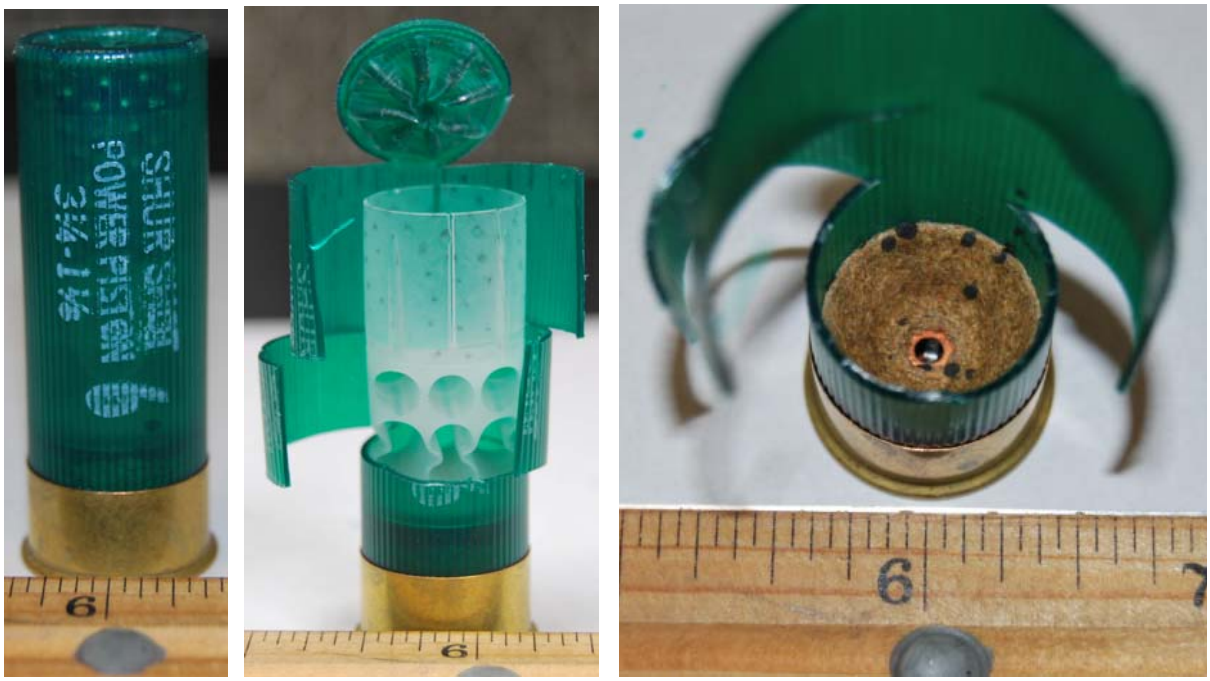

Figure 10. Dissection of sample AE1386 from left to right showing: uncut, shot removed, and powder removed to reveal basewad.

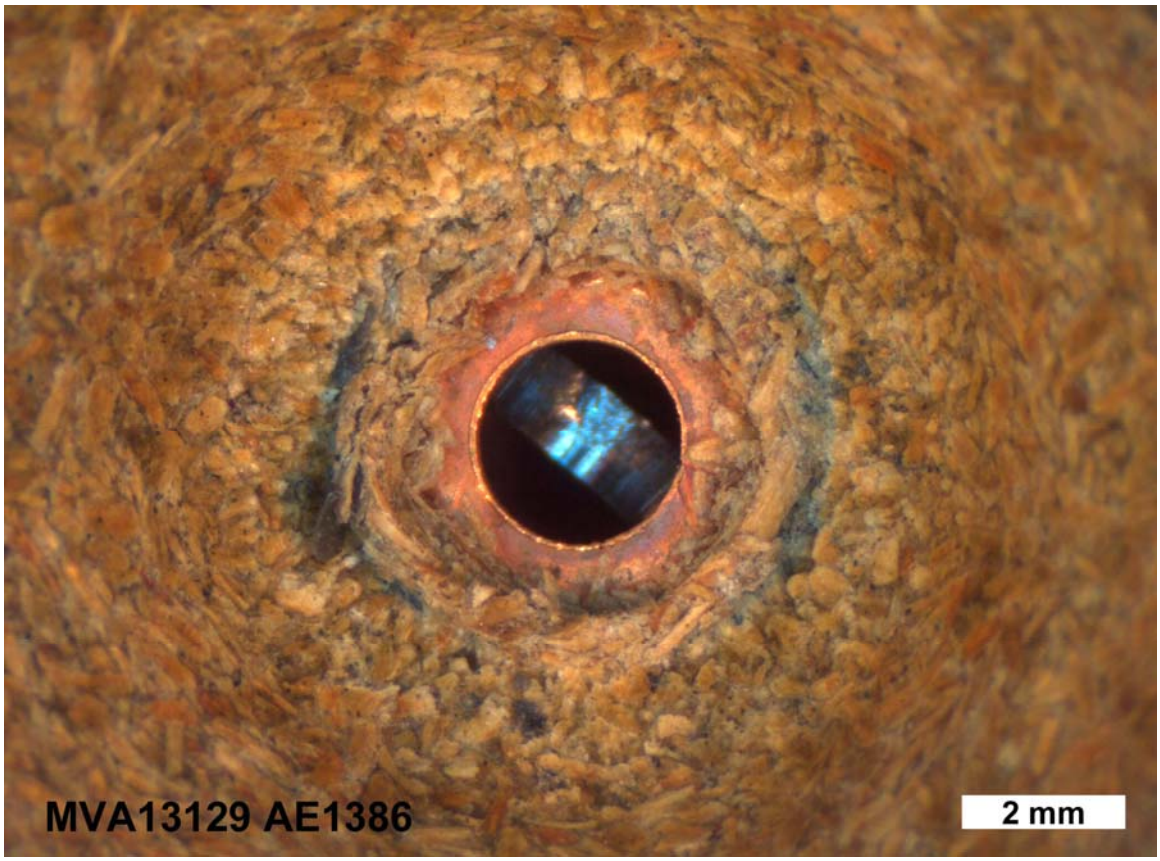

Figure 11. Stereomicroscope image of basewad, sample AE1386.

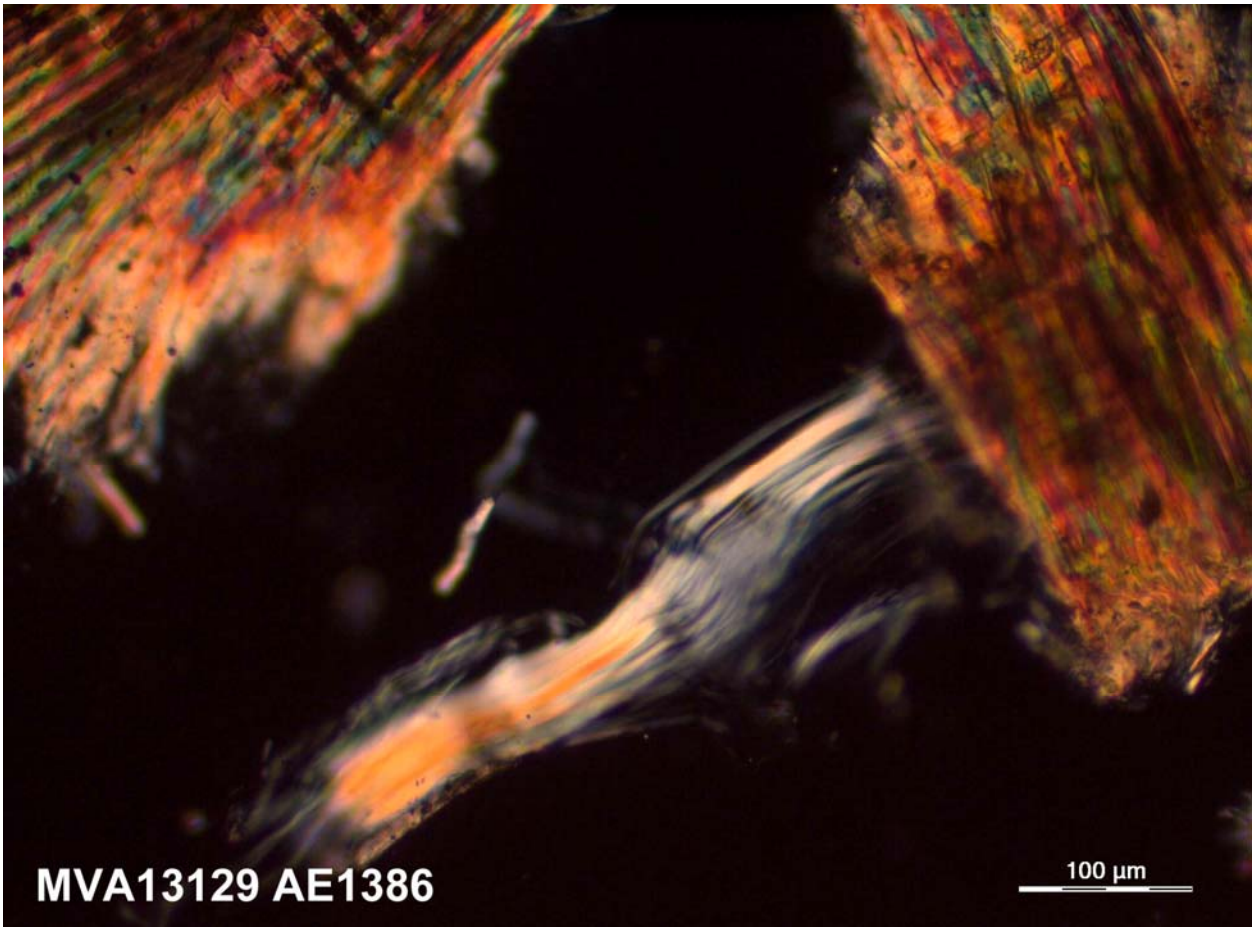

Figure 12. PLM image of chrysotile asbestos fibers and bundles (white) from basewad, sample AE1386.

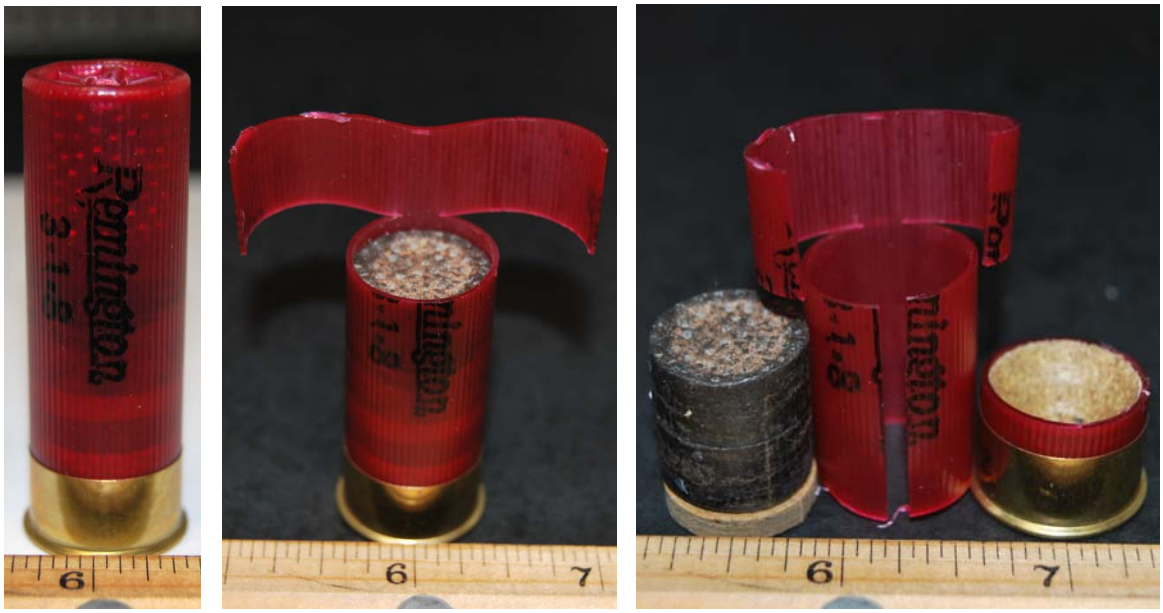

Figure 13. Dissection of sample AE1387 from left to right showing: uncut, shot removed to reveal wads, and showing wads, casing and basewad.

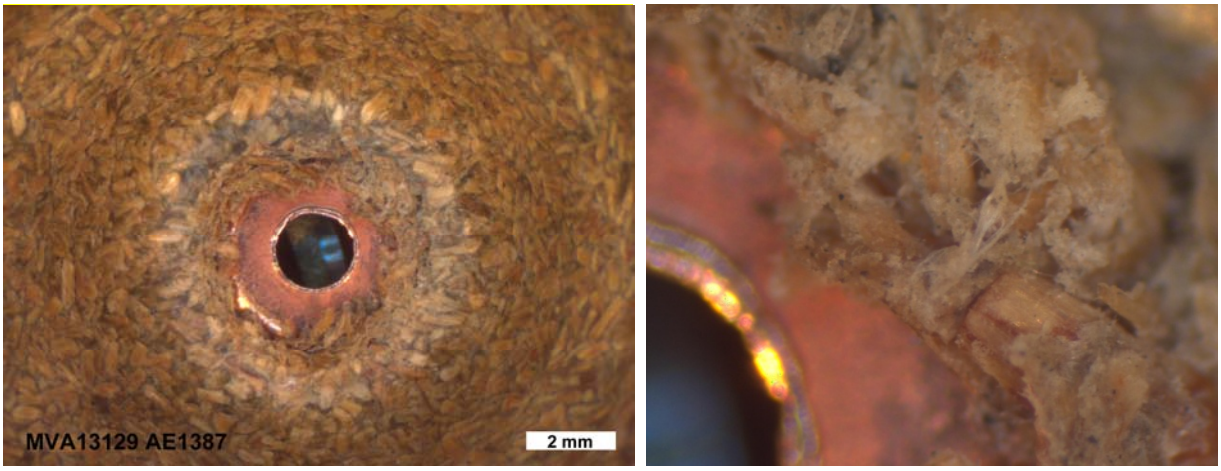

Figure 14. Stereomicroscope images of basewad (left) and chrysotile bundle in basewad (right) of sample AE1387.

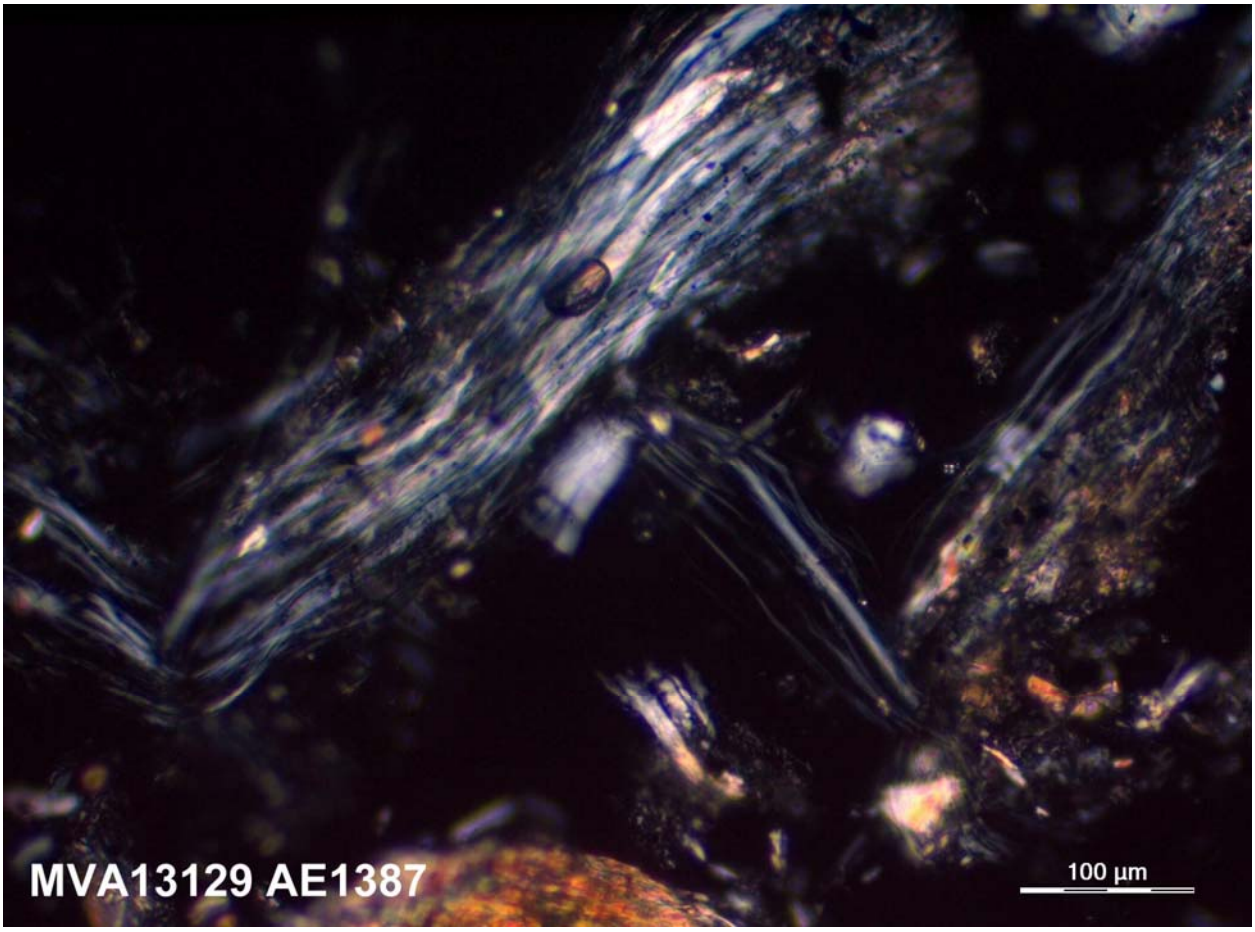

Figure 15. PLM image of chrysotile asbestos fibers and bundles (white) from basewad, sample AE1387.

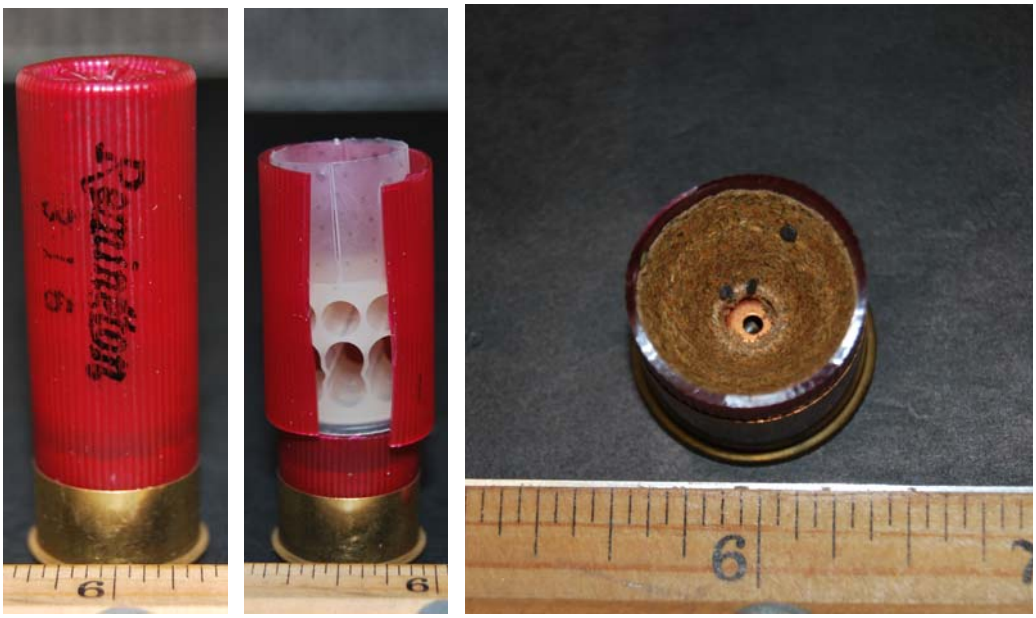

Figure 16. Dissection of sample AE1388 from left to right showing: uncut, shot removed to show shot holder, and basewad.

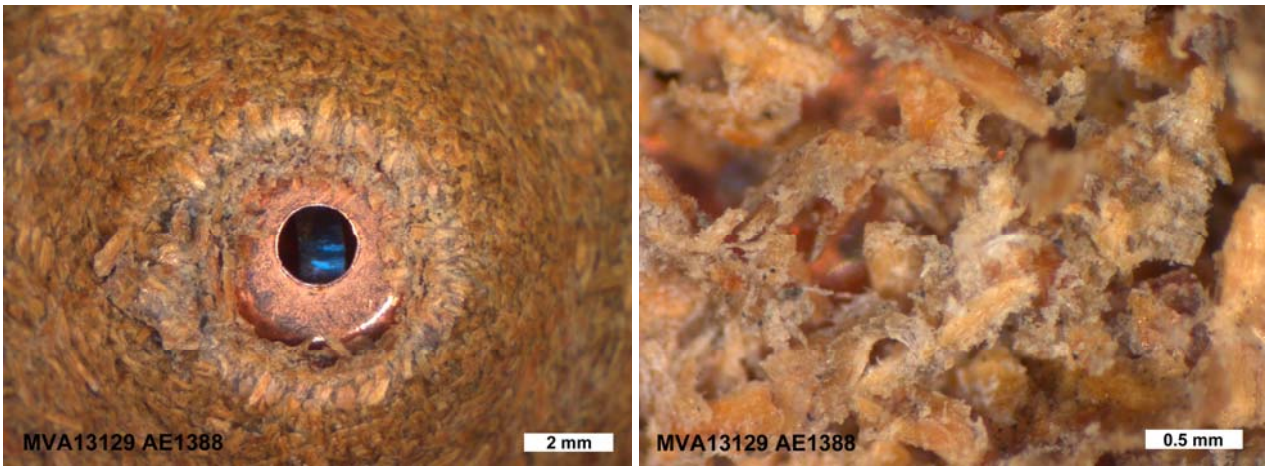

Figure 17. Stereomicroscope images of basewad (left) and chrysotile bundle in basewad (right) of sample AE1388.

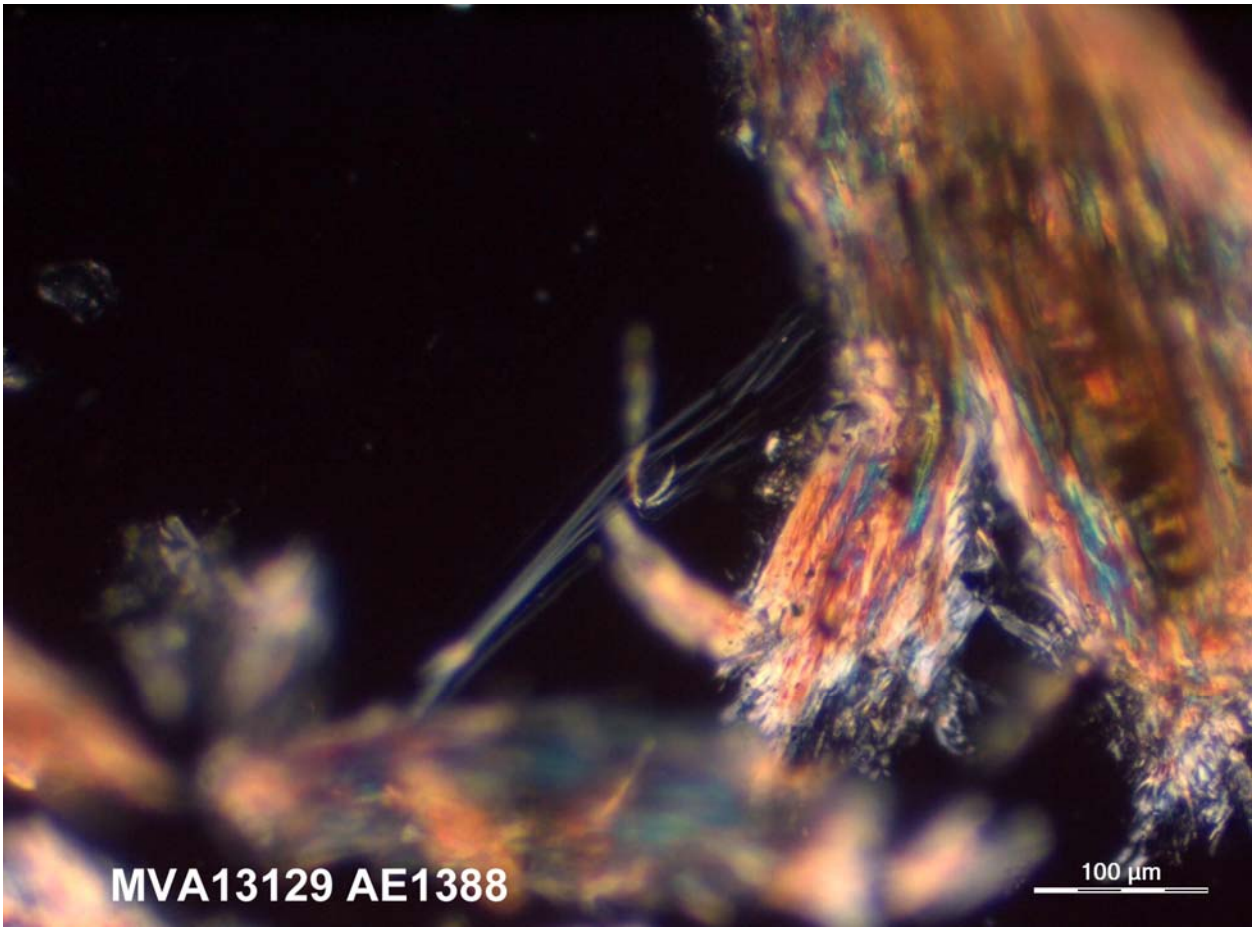

Figure 18. PLM image of chrysotile asbestos fibers and bundles (white) from basewad, sample AE1388.

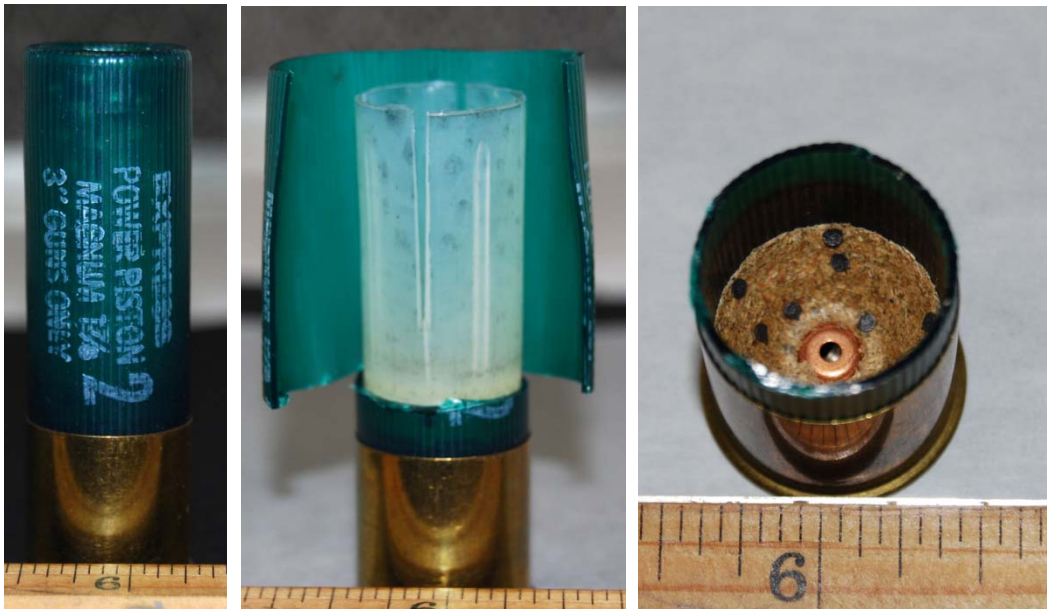

Figure 19. Dissection of sample AE1389 from left to right showing: uncut, shot removed to show shot holder, and basewad.

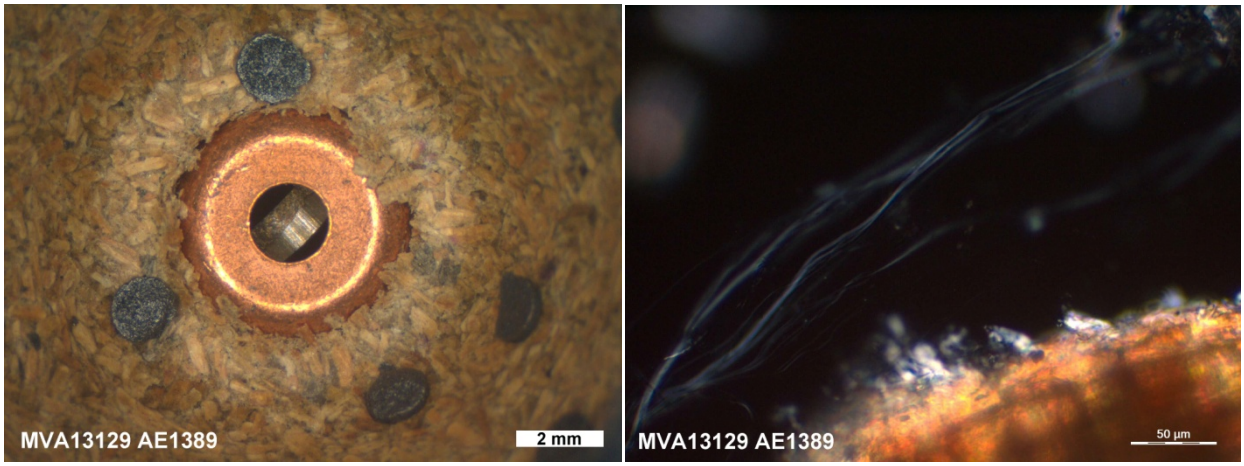

Figure 20. Stereomicroscope image of basewad (left) and PLM image of chrysotile bundle in basewad (right) of sample AE1389.

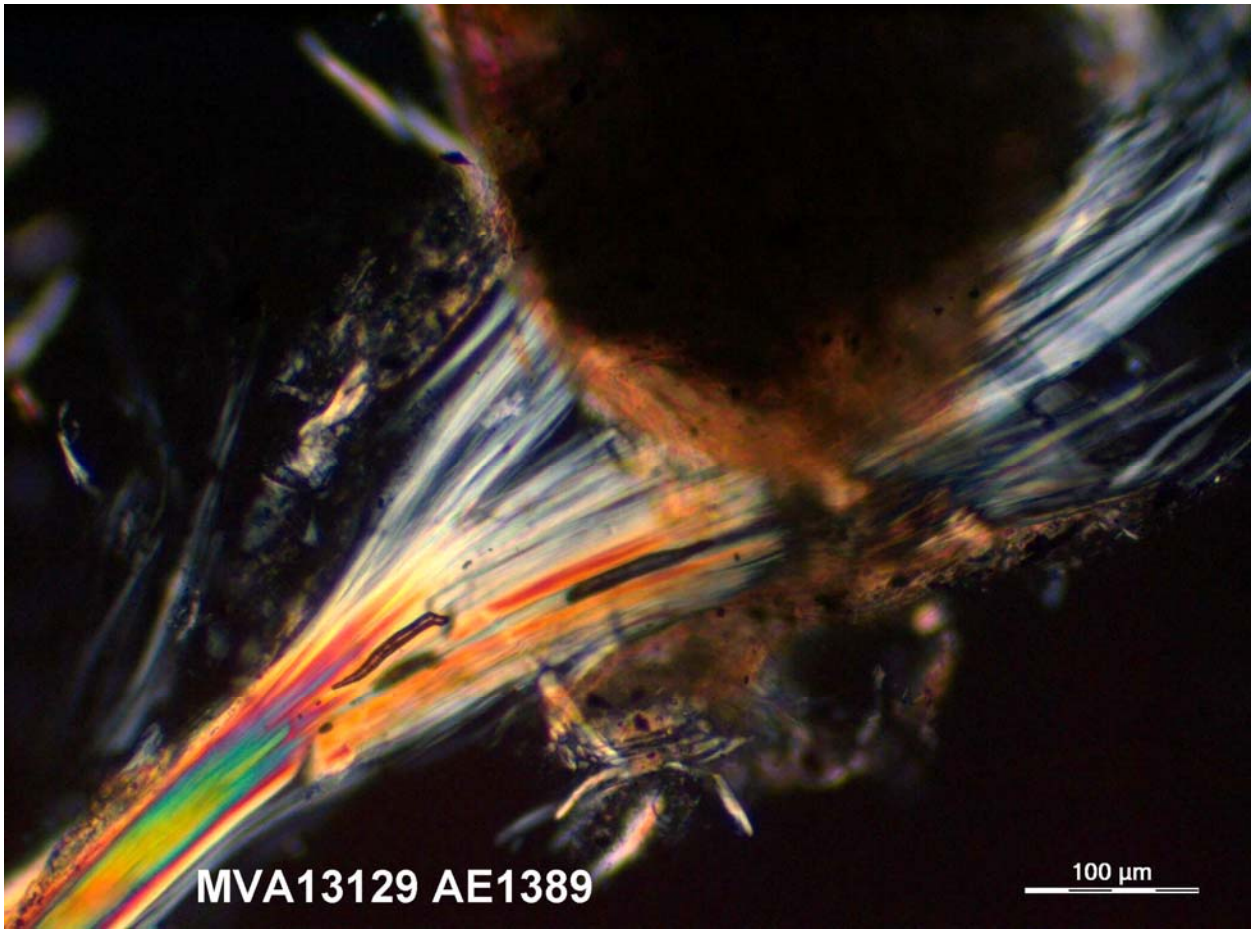

Figure 21. PLM image of chrysotile asbestos fibers and bundles from basewad, sample AE1389.

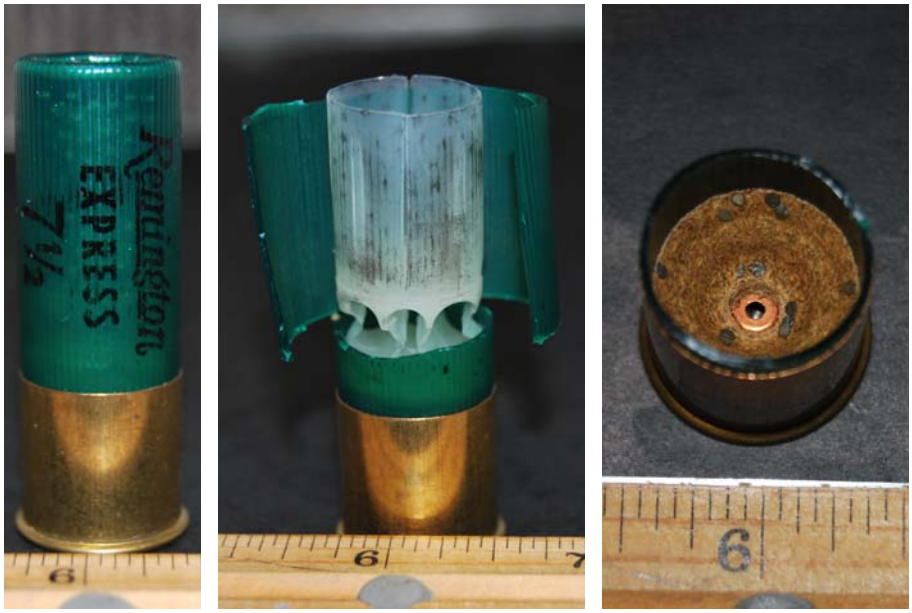

Figure 22. Dissection of sample AE1390 from left to right showing: uncut, shot removed to show shot holder, and basewad.

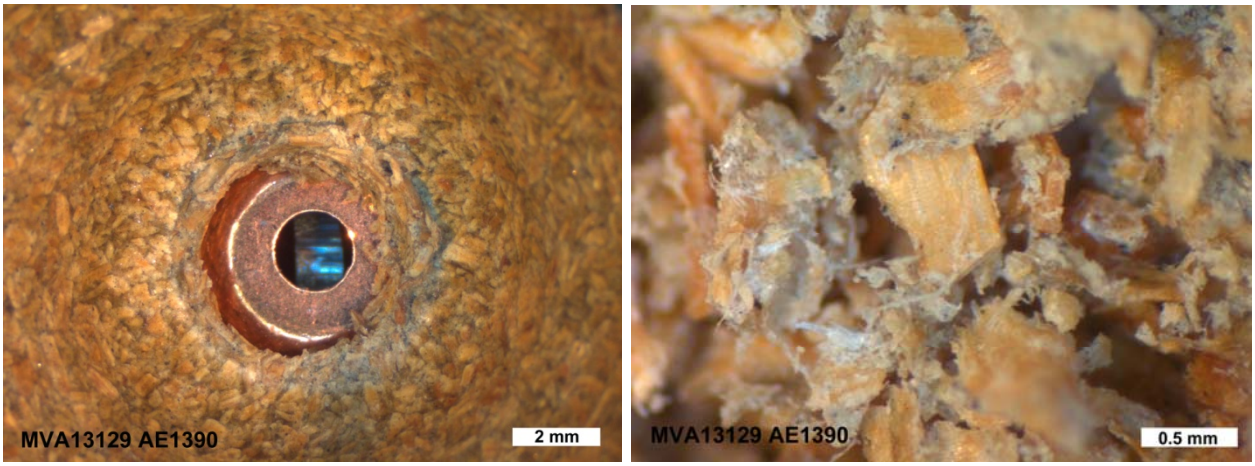

Figure 23. Stereomicroscope images of basewad (left) and chrysotile bundle in basewad (right) of sample AE1390.

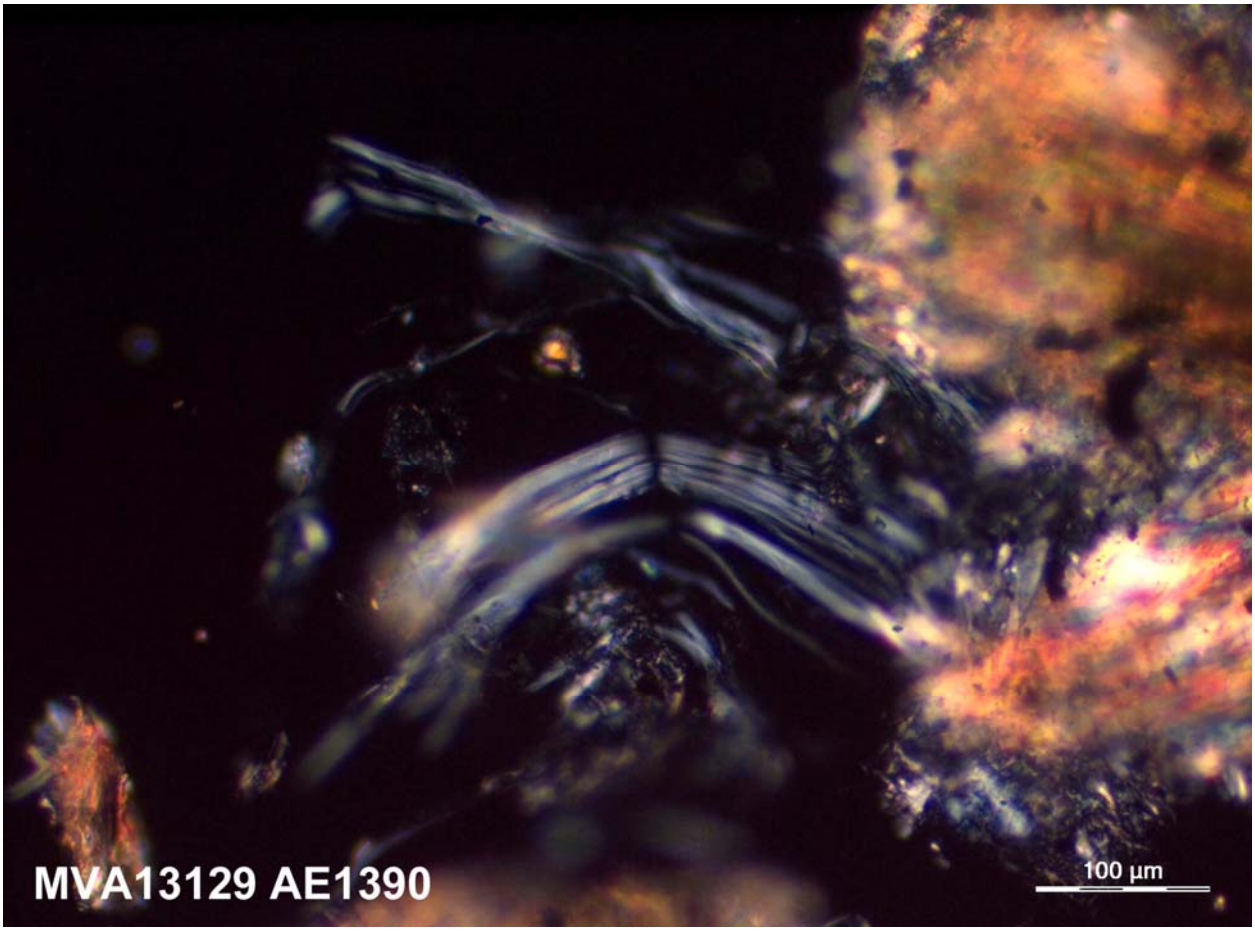

Figure 24. PLM image of chrysotile asbestos fibers and bundles (white) from basewad, sample AE1390.

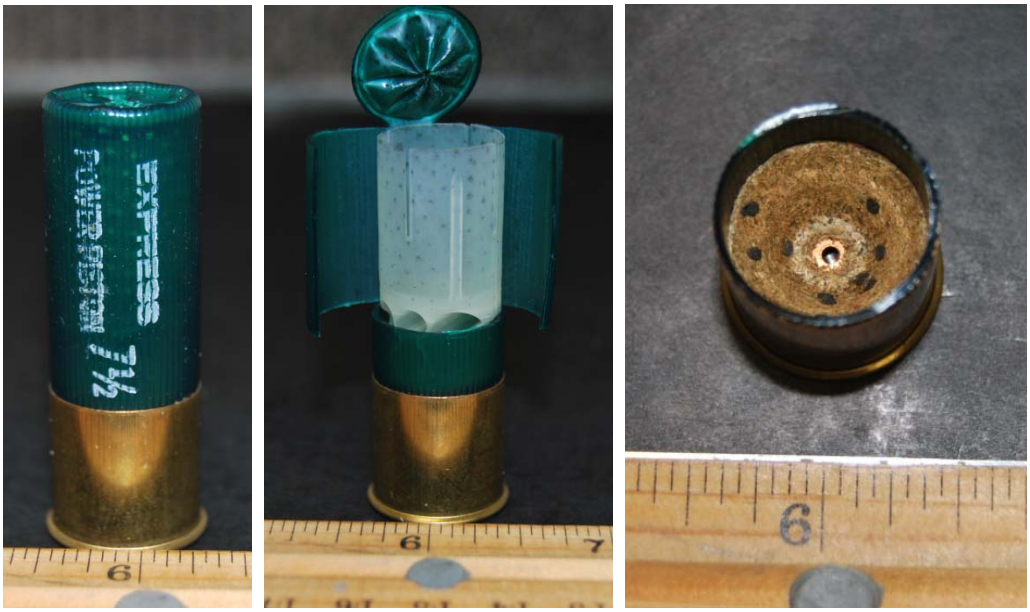

Figure 25. Dissection of sample AE1391 from left to right showing: uncut, shot removed to show shot holder, and basewad.

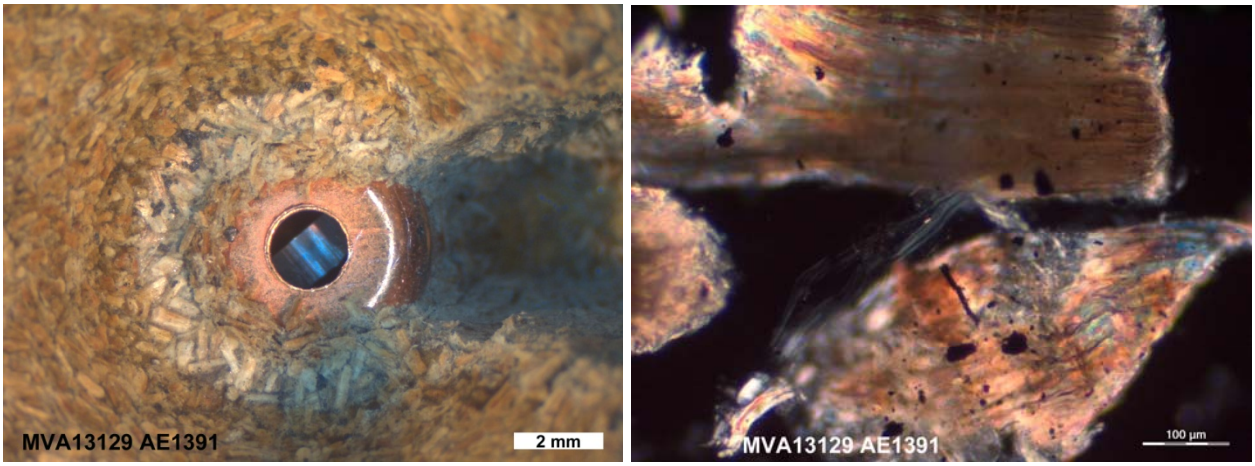

Figure 26. Stereomicroscope image of basewad (left) and PLM image of chrysotile bundle in basewad (right) of sample AE1391.

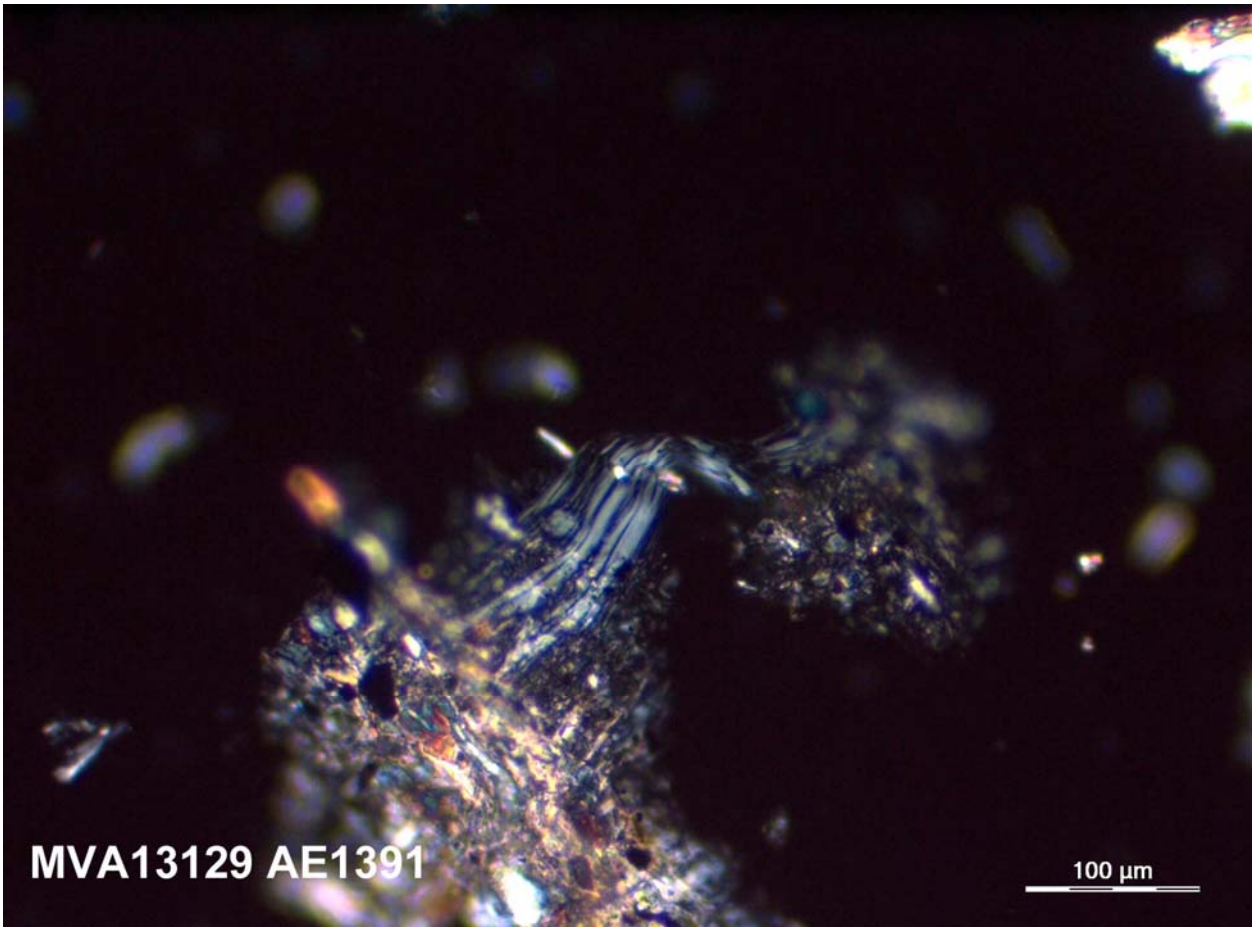

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Figure 27. PLM image of chrysotile asbestos fibers and bundles (white) from basewad, sample AE1391.

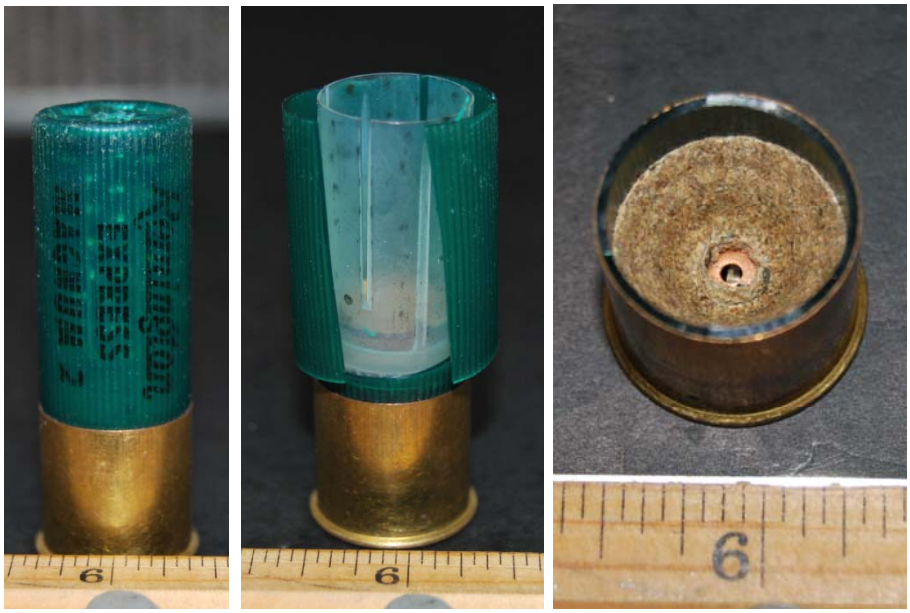


Figure 28. Dissection of sample AE1392 from left to right showing: uncut, shot removed to show shot holder, and basewad.

Figure 29. Stereomicroscope image of basewad in sample AE1392.

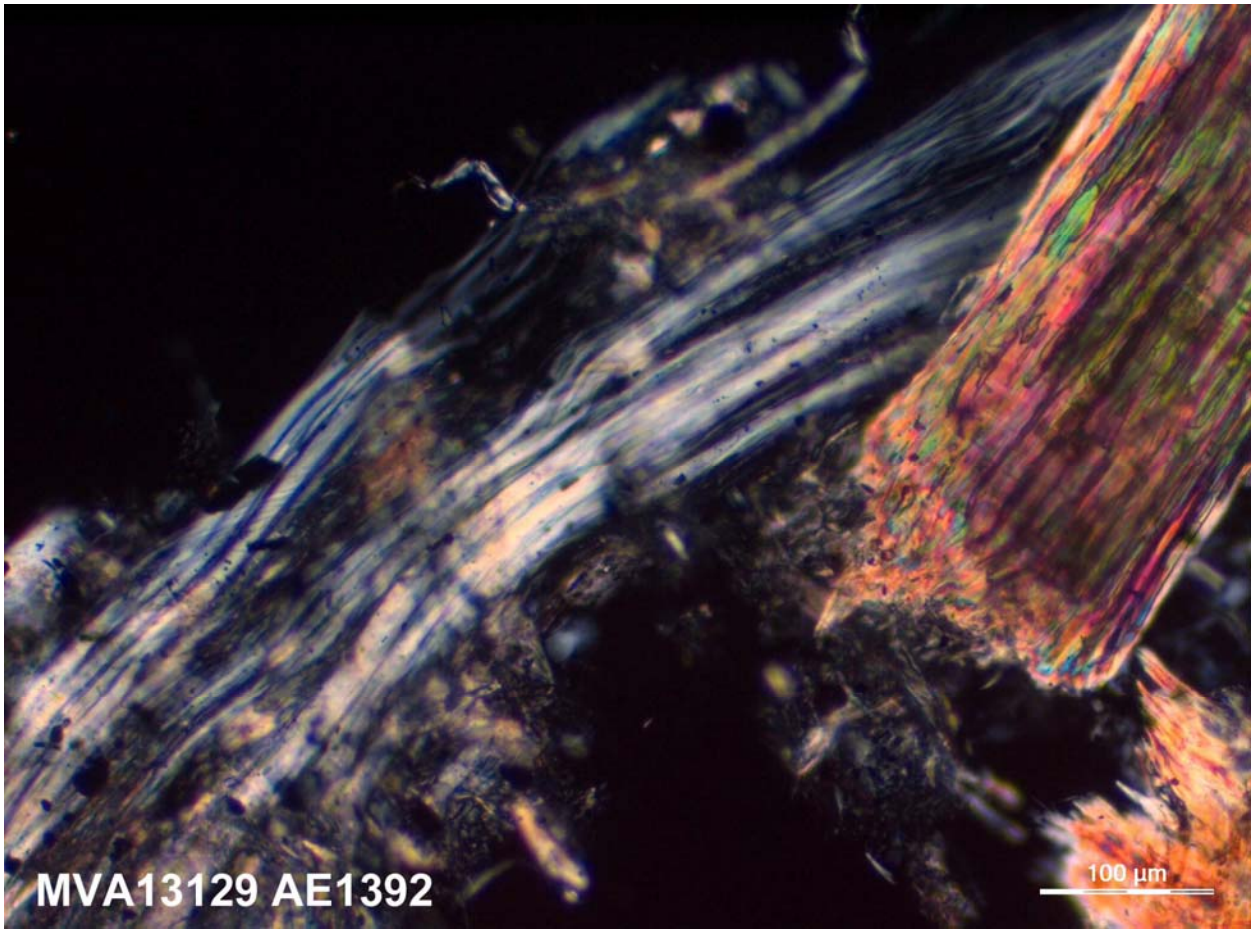


Figure 30. PLM image of chrysotile asbestos fibers and bundles (white) from basewad, sample AE1392.

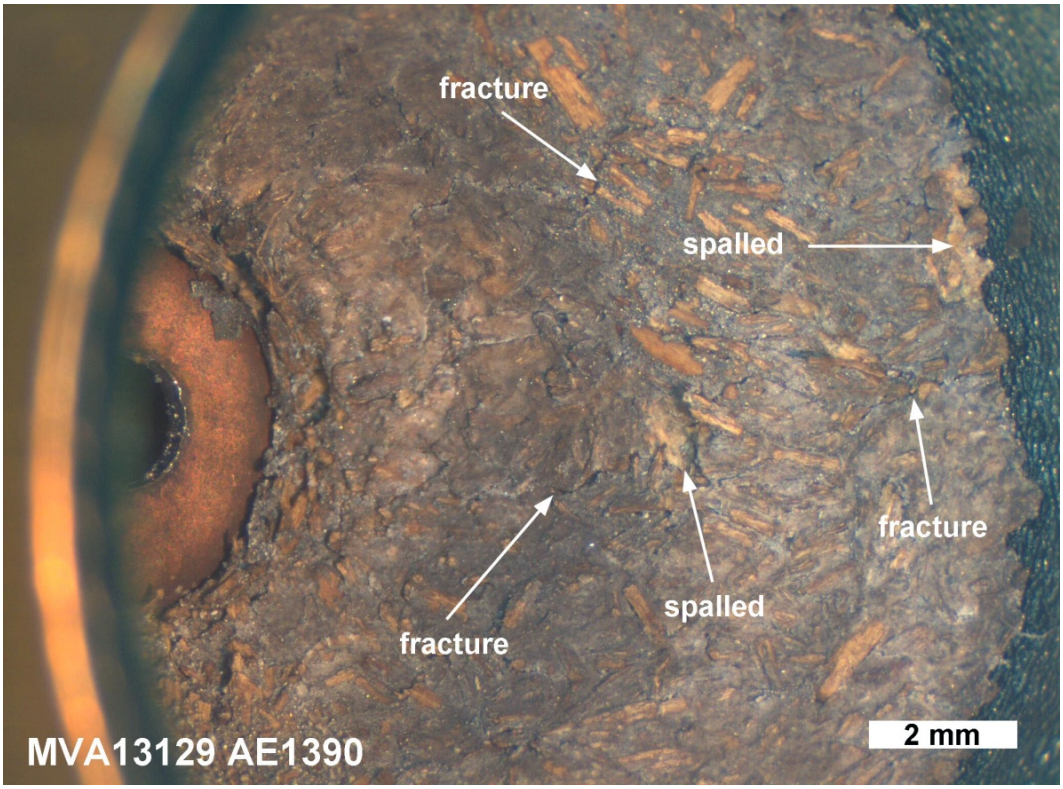


Figure 31. Stereomicroscope image of basewad from sample AE1390, after firing.

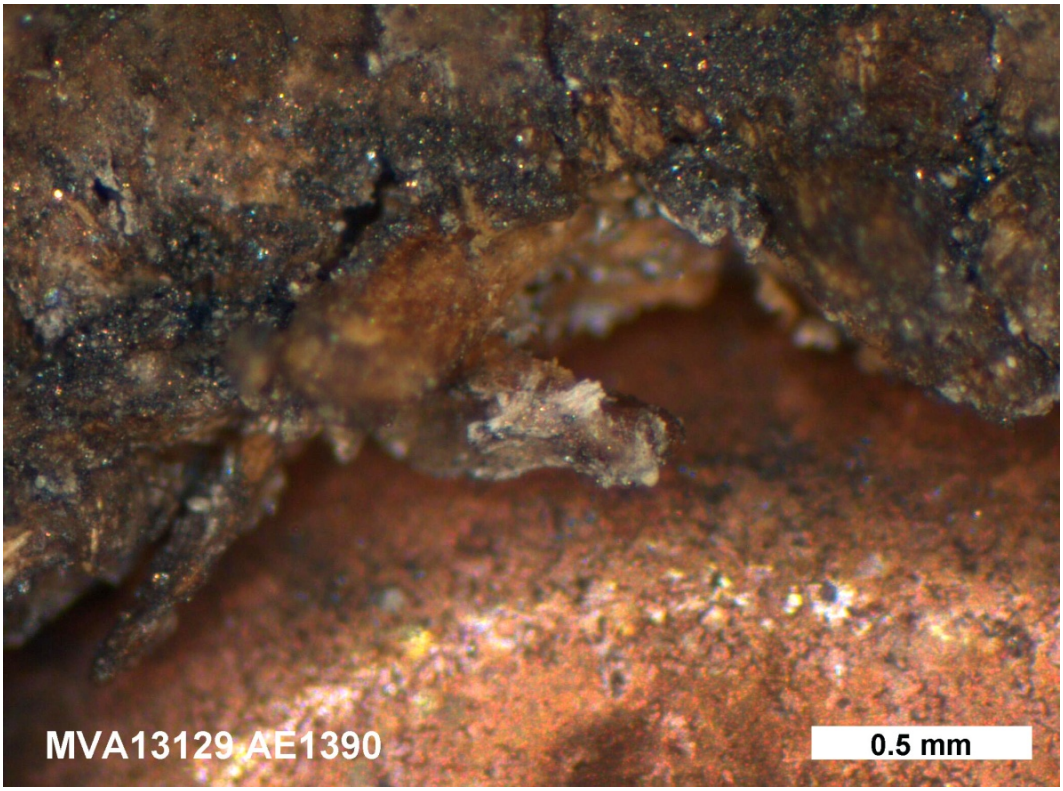


Figure 32. Stereomicroscope image of chrysotile bundle in sample AE1390, after firing.

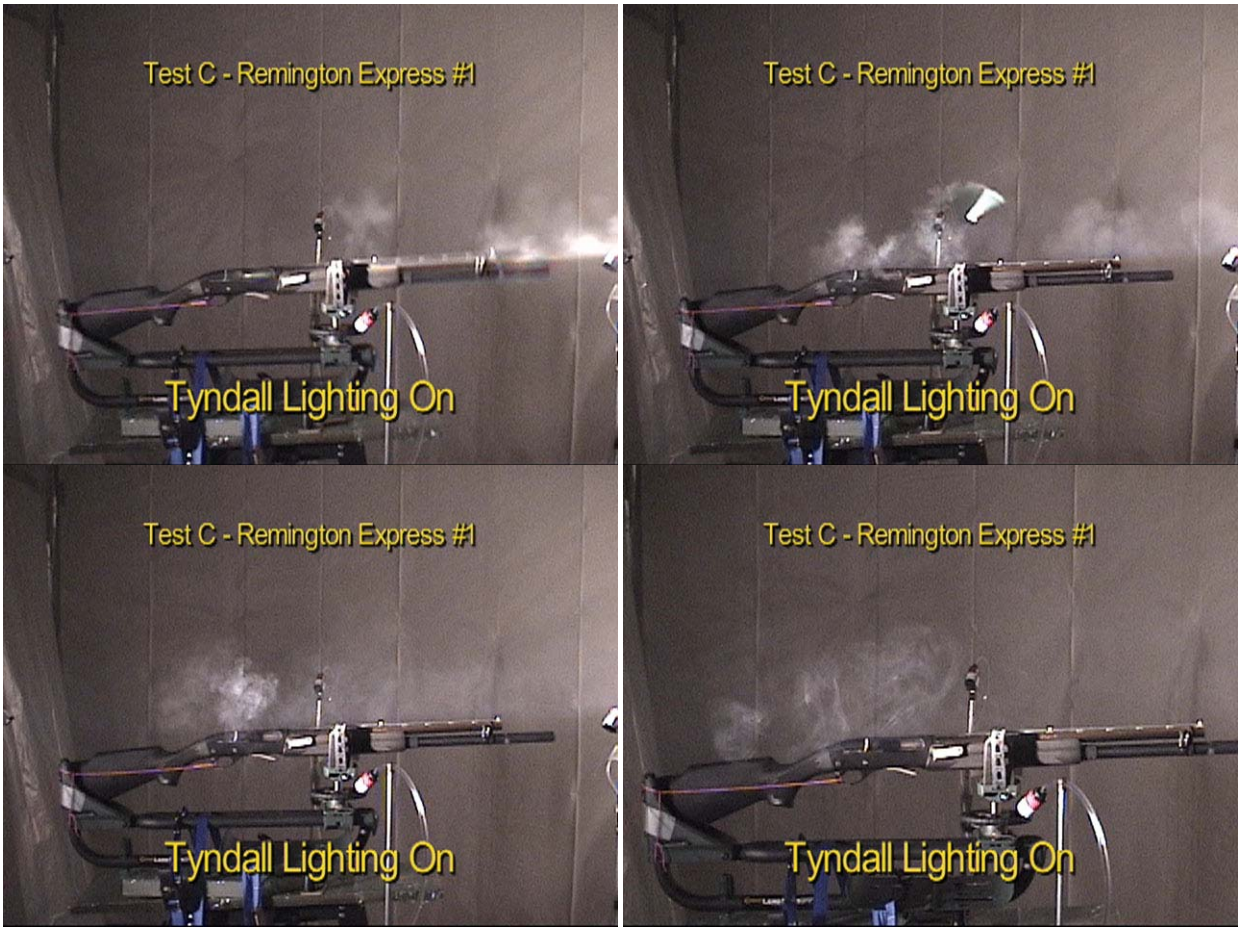


Figure 33. Still images, taken from video recording of Test C, demonstrating the propagation of dust after firing.

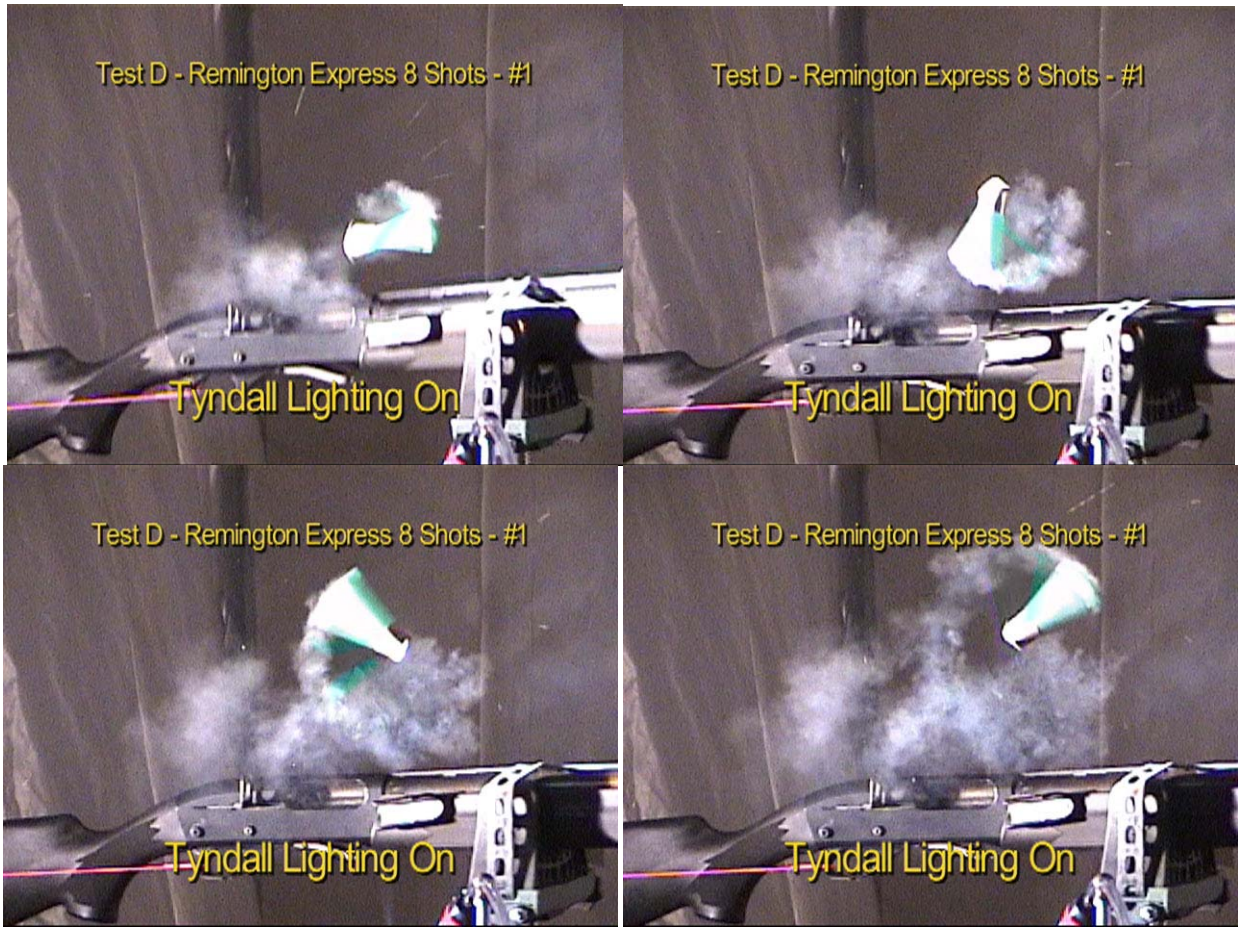
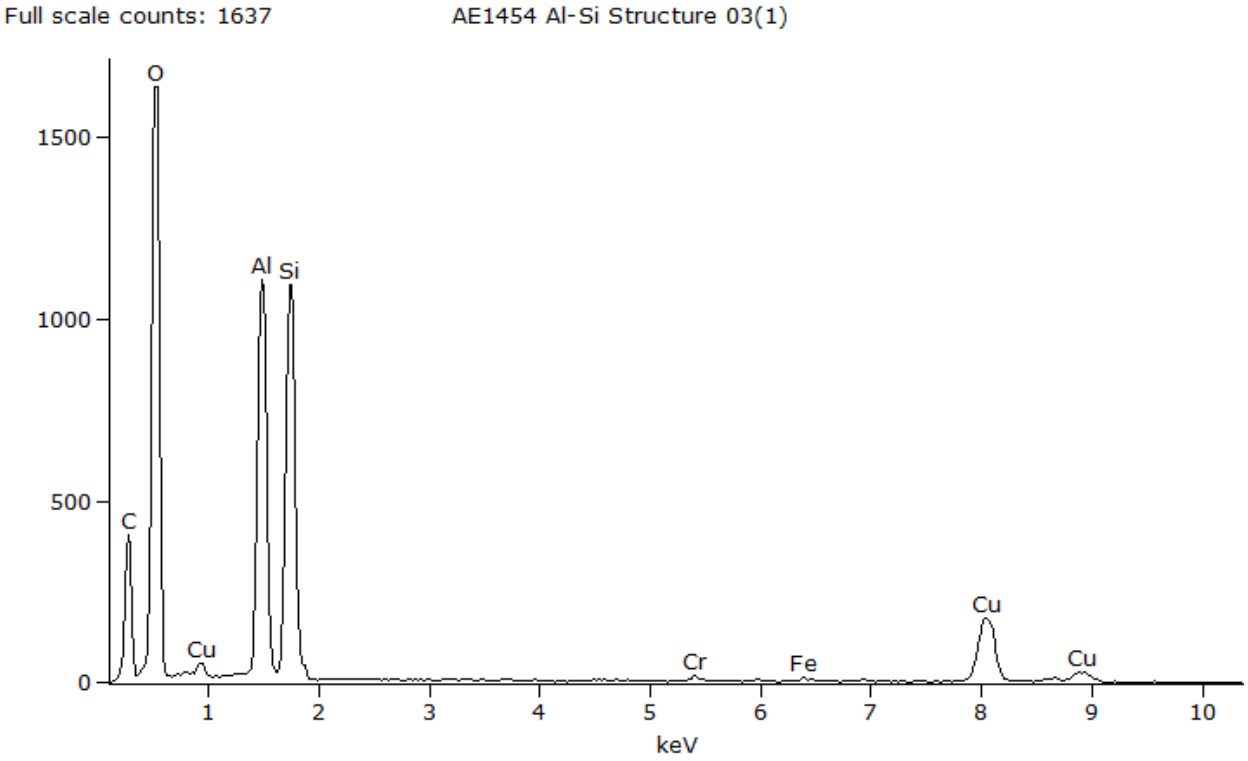


Figure 34. Still images, taken from video recording of Test D, demonstrating the propagation of dust from the end of the spent shell.

Figure 35. TEM image (above) and EDS spectrum (below) of representative fibrous silicate detected in the environment from air sample AE1454 (Test A – Pump #05).



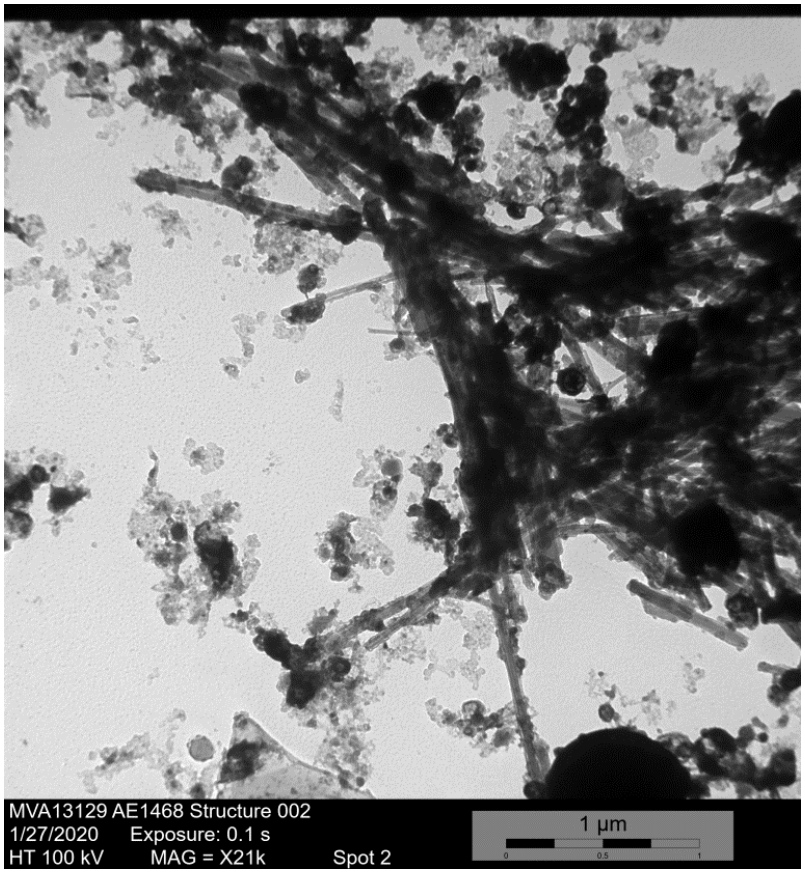
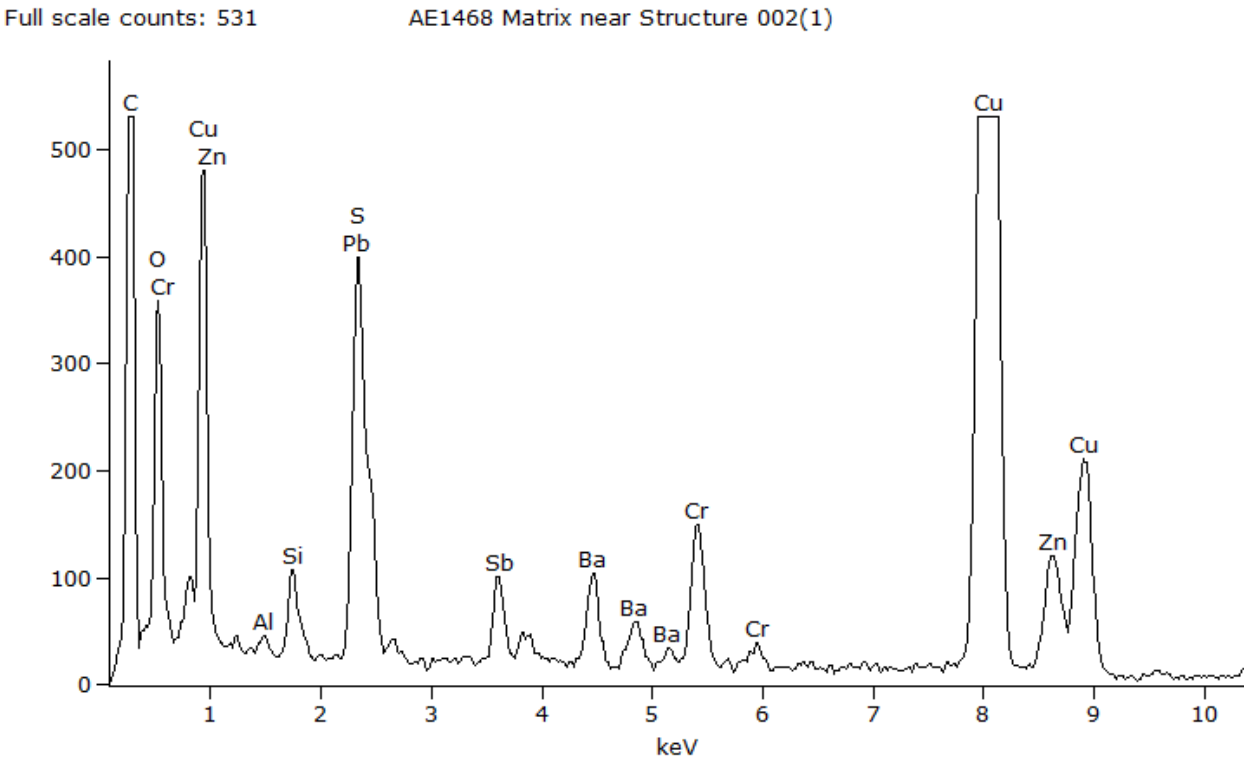


Figure 36. TEM image (above) and EDS spectrum (below) of non-fibrous gunshot residue near a chrysotile fiber bundle from air sample AE1468 (Test D – Pump #01).



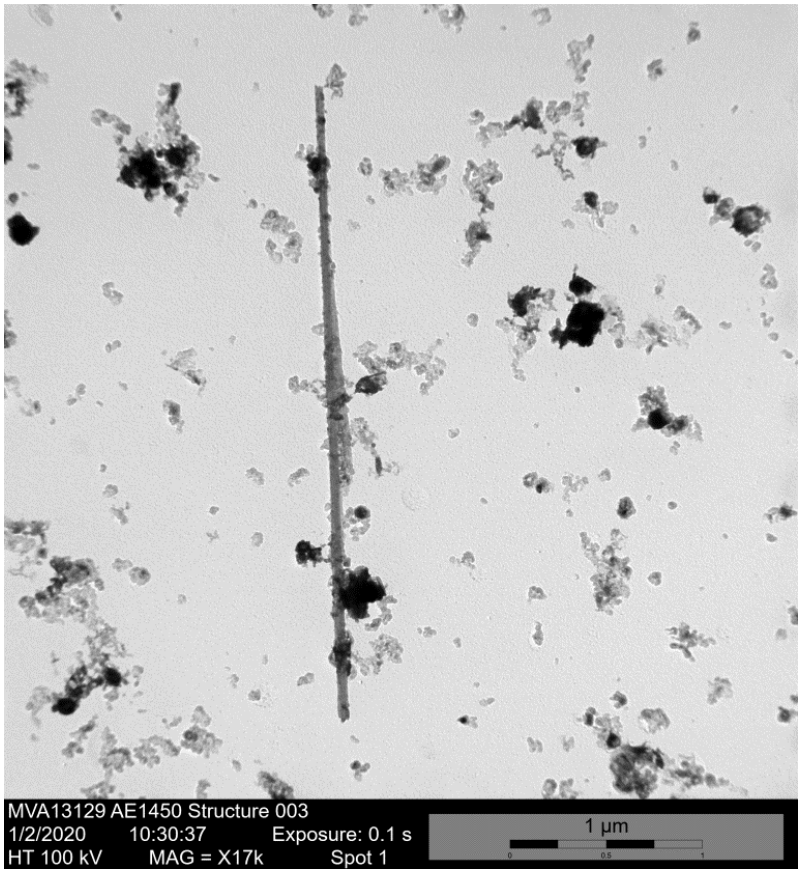
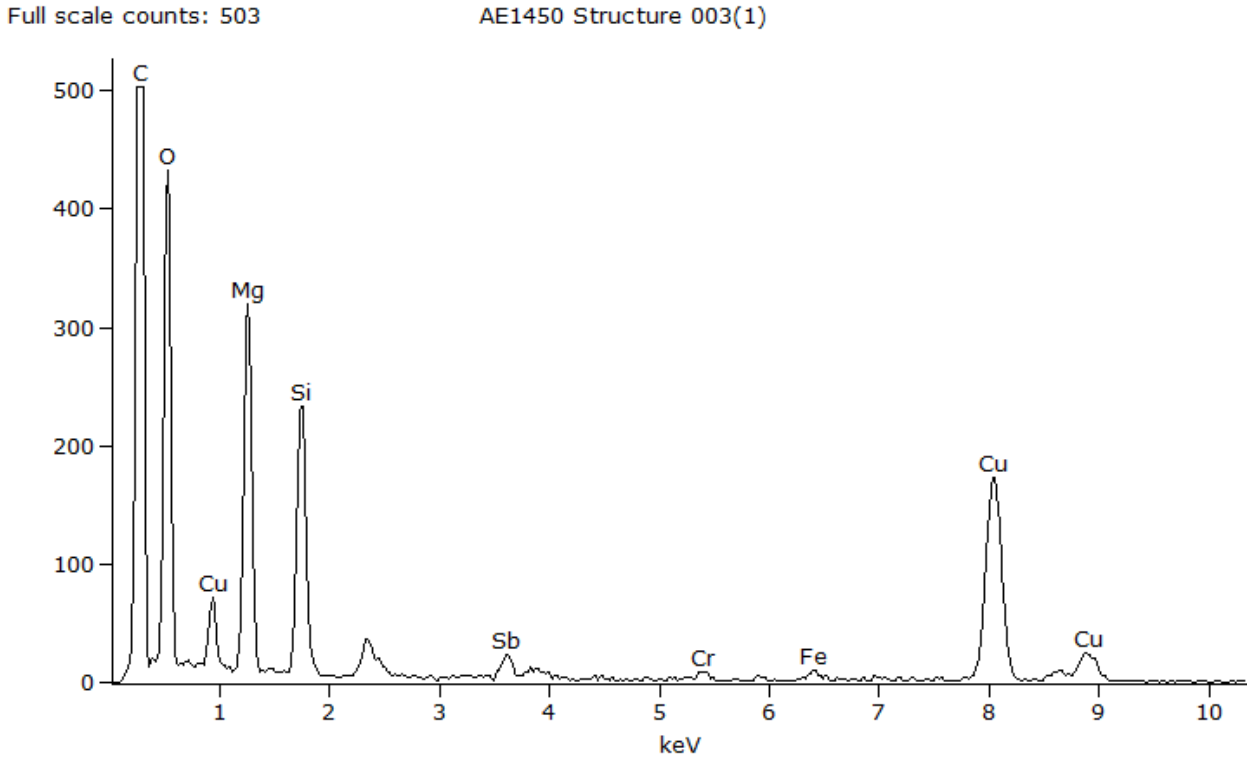


Figure 37. TEM image (above) and EDS spectrum (below) of a chrysotile fiber from air sample AE1450 (Test A – Pump #01).



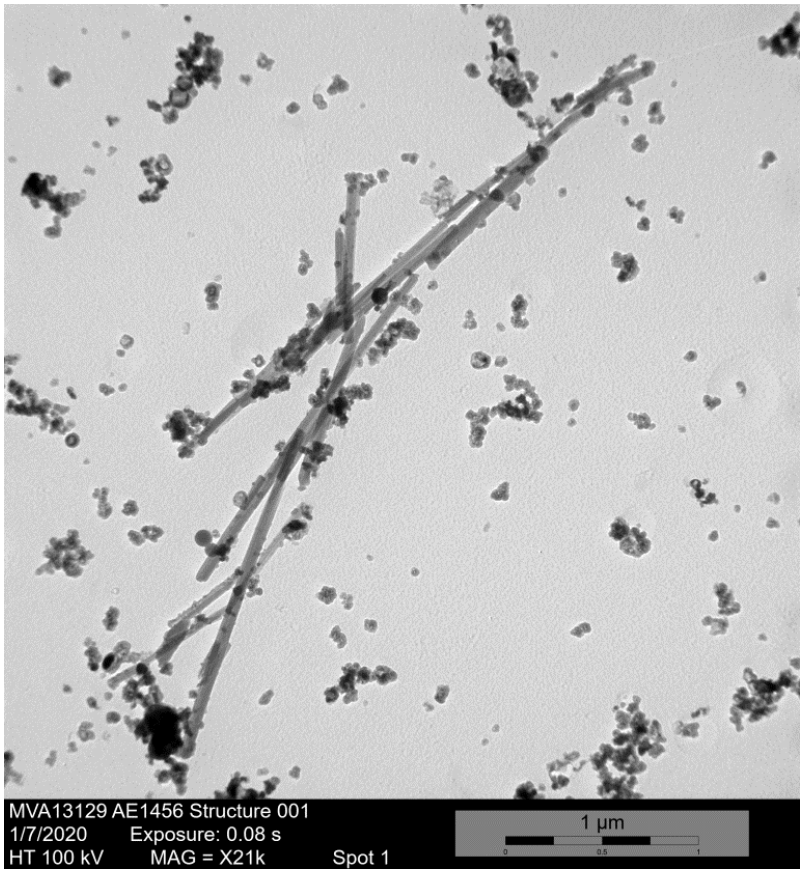
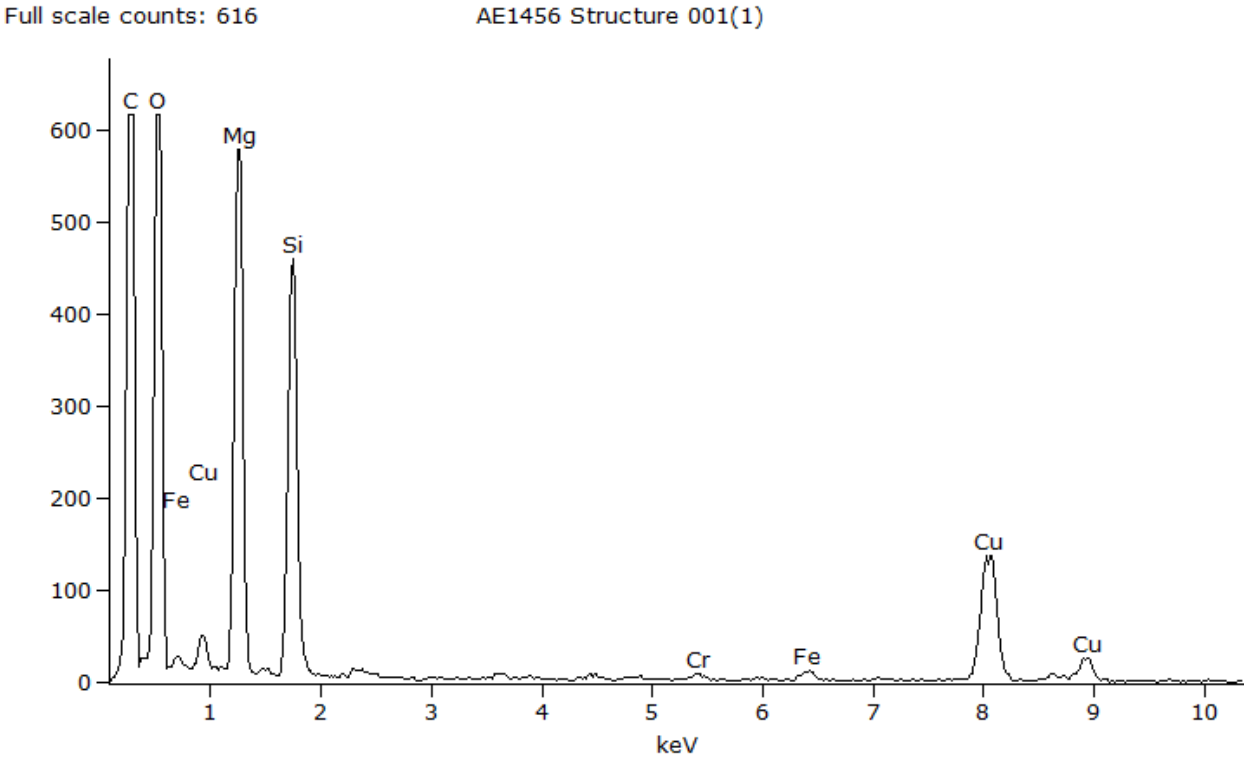


Figure 38. TEM image (above) and EDS spectrum (below) of a chrysotile fiber bundle from air sample AE1456 (Test B – Pump #01).



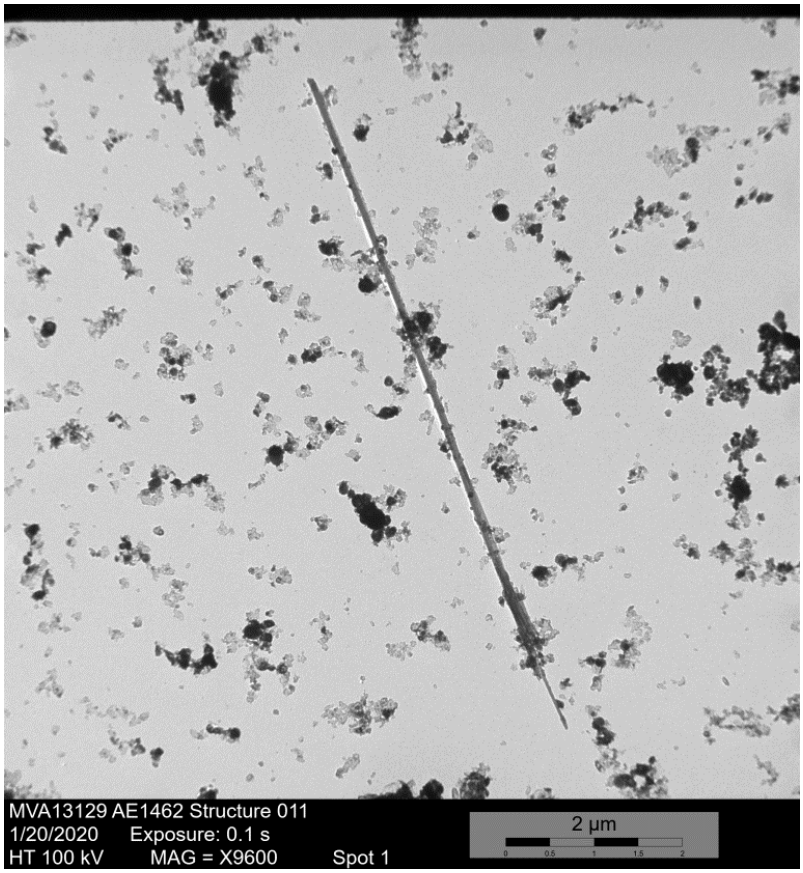
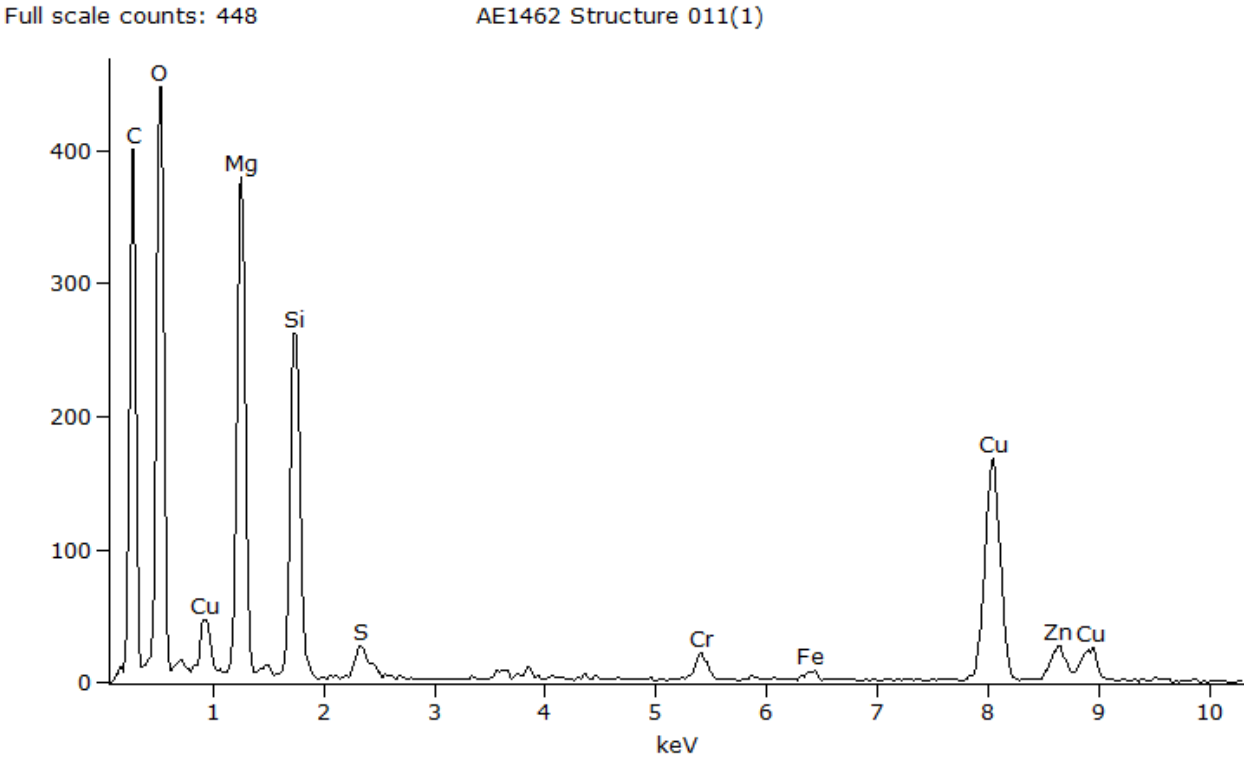


Figure 39. TEM image (above) and EDS spectrum (below) of a chrysotile fiber bundle from air sample AE1462 (Test C – Pump #01).



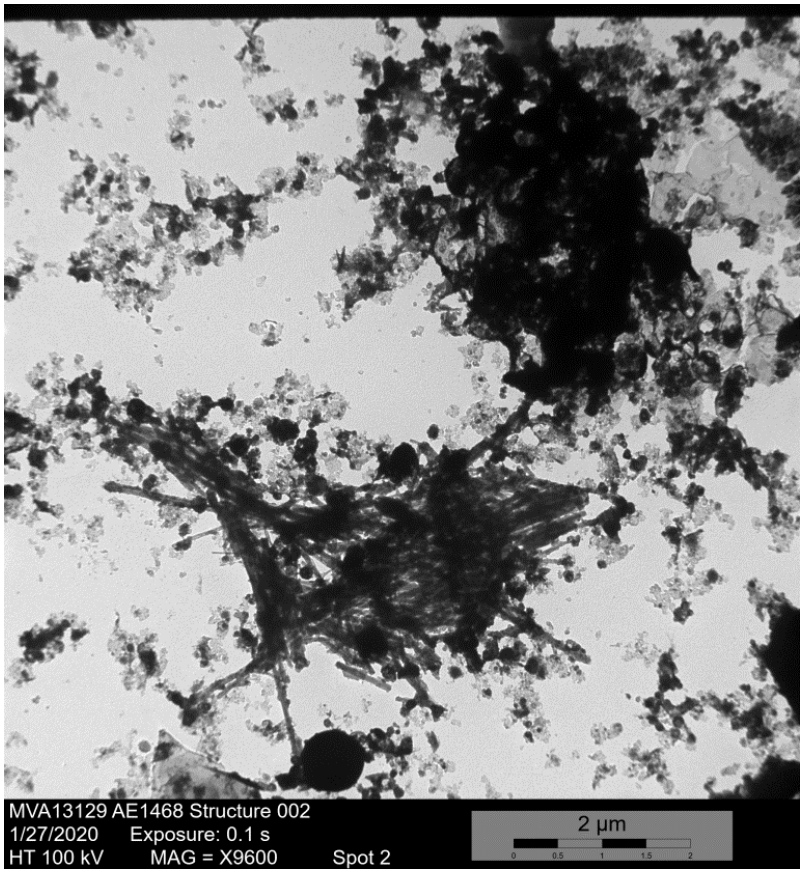
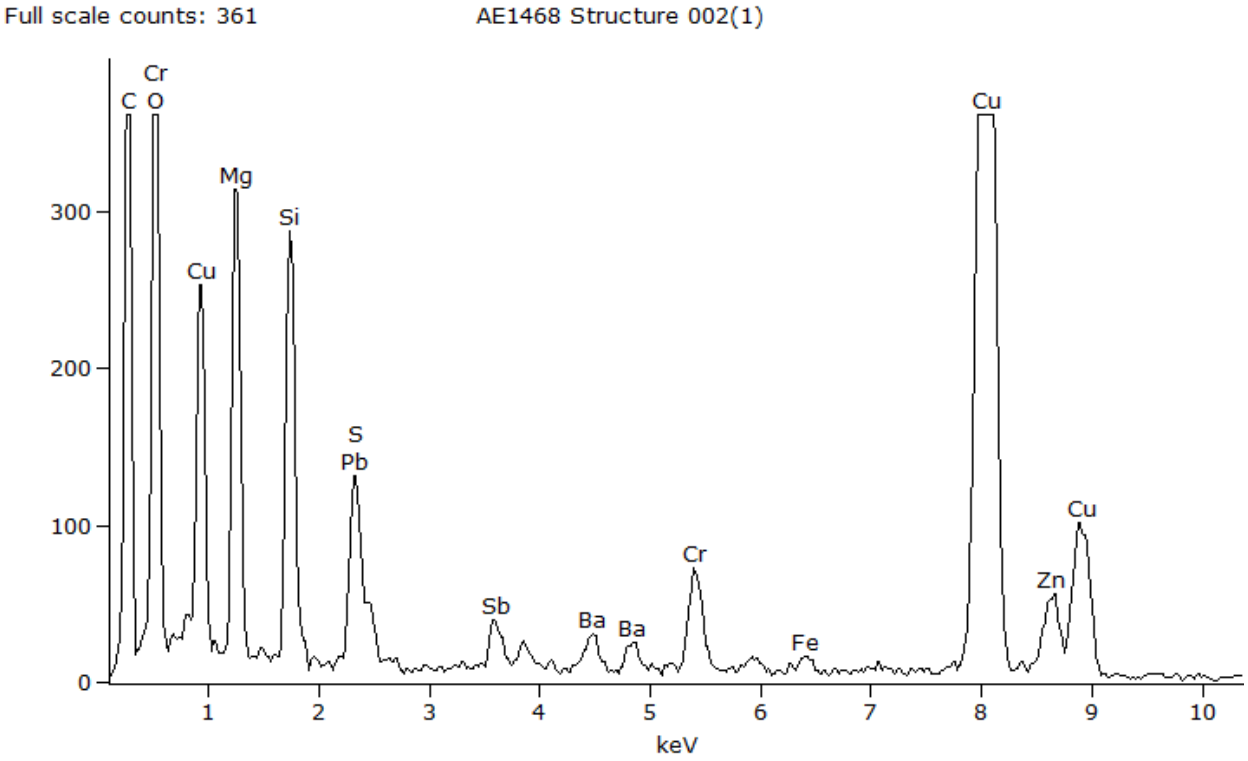


Figure 40. TEM image (above) and EDS spectrum (below) of a clustered chrysotile fiber bundle from air sample AE1468 (Test D – Pump #01).



APPENDIX

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	150	**Analyst:**	MRU
Lab Sample I.D.:	AE1448	**Grid Opening (mm^2):**	0.01	**Date:**	11/19/19 - 11/20/19
Client Sample I.D.:	Background	**Filter Area (mm^2):**	385	**Comments:**	013G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 2
Magnification:	20,800	**Openings Analyzed:**	40		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
A10	A3-3	NSD						
	A3-6	NSD						
	A4-1	NSD						Al-Si Str 01
	A4-3	NSD						
	A4-6	NSD						
	A5-4	NSD						Al-Si Str 02
	A5-6	NSD						
	B6-4	NSD						
	B6-1	NSD						
	B5-3	NSD						
	B5-4	NSD						
	B4-6	NSD						Al-Si Str 03
	B4-3	NSD						
	B3-3	NSD						
	B3-6	NSD						
	C3-3	NSD						
	C3-6	NSD						
	C4-6	NSD						
	C5-1	NSD						
	C5-4	NSD						
A9	G2-6	NSD						
	G2-3	NSD						
	G3-1	NSD						
	G3-6	NSD						
	G4-4	NSD						

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	150	**Analyst:**	MRU
Lab Sample I.D.:	AE1448	**Grid Opening (mm^2):**	0.01	**Date:**	11/19/19 – 11/20/19
Client Sample I.D.:	Background	**Filter Area (mm^2):**	385	**Comments:**	013G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	2 of 2
Magnification:	20,800	**Openings Analyzed:**	40		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
A9	G4-1	NSD						
	G5-1	NSD						
	G5-3	NSD						
	F5-6	NSD						
	F5-3	NSD						
	F4-3	NSD						
	F4-4	NSD						
	F4-1	NSD						
	F3-6	NSD						
	F3-4	NSD						
	E3-4	NSD						
	E3-6	NSD						
	E4-4	NSD						
	E4-6	NSD						
	E5-4	NSD						

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	76	**Analyst:**	MRU
Lab Sample I.D.:	AE1449	**Grid Opening (mm^2):**	0.01	**Date:**	12/31/2019
Client Sample I.D.:	Background	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	20		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
E2	C3-4	NSD						
	C4-4	AI-001	F		X	N	N	AI Structure
	E5-3	NSD						
	E4-6	AI-002	F		X	N	N	AI Structure
	E3-1	NSD						
	E2-6	NSD						
	F2-3	NSD						
	F5-4	NSD						
	G6-4	NSD						
	G3-1	NSD						
D2	B3-4	NSD						
	B4-6	AI-003	C		X	N	N	AI Structure
	C5-4	NSD						
	C4-4	NSD						
	C3-1	NSD						
	C2-6	NSD						
	E2-3	AI-004	C		X	N	N	AI Structure
	E3-3	NSD						
	E4-4	NSD						
	E5-4	NSD						

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1450	G.O. Area (mm2):	0.01	Date:	11/11/19 - 11/14/19
Client Sample I.D.:	Test A - Pump 1	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	31	Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	1 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
E10	L3-3	1	M	13.6	3.40		N		13.0	3.24
	L4-1	NSD								
	L5-1	NSD								
	K5-3	NSD						Chrys <.25µm diam		
	K4-4	NSD								
	K4-1	NSD								
	K3-3	NSD								
	K3-6	NSD								
	K3-4	NSD								
	H3-1	NSD								
	H4-1	NSD								
	H4-3	NSD								
	G4-3	NSD								
	G3-4	NSD								
E9	C5-3	NSD								
	C5-1	NSD								
	C4-3	NSD								
	C3-6	NSD								
	C2-3	NSD								
	E2-3	NSD								
	E3-4	NSD								
	E3-6	NSD								
	E4-4	2	F	18.0	0.30		N		17.1	0.29
	E5-1	NSD								
	E5-3	NSD								
	F5-1	NSD								
	F3-3	NSD								
E8	E4-6	NSD								
	E5-4	NSD								
	F5-6	NSD								
	F4-1	NSD								
	F3-4	NSD								
	G3-3	NSD								
	G4-4	NSD								
	G5-3	NSD								
	G6-1	NSD								
	H6-1	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1450	G.O. Area (mm2):	0.01	Date:	11/11/19 - 11/14/19
Client Sample I.D.:	Test A - Pump 1	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	31	Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	2 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
E8	H5-4	NSD						Chrys <5µm		
	H4-4	NSD								
	H3-4	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	31	**Analyst:**	MRU
Lab Sample I.D.:	AE1450	**Grid Opening (mm^2):**	0.01	**Date:**	1/2/2020
Client Sample I.D.:	Test A – P1	**Filter Area (mm^2):**	385	**Comments:**	013G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
E10	H4-3	AlSi01	F	X		N	N	
		AlSi02	B	X		N	N	
	H3-3	AlSi03	F		X	N	N	
	G3-6	001	B	X		C	C	
	G6-3	AlSi04	F		X	N	N	
	F4-4	002	B	X		C	C	
E9	E4-6	003	B	X		C	C	
	E5-3	004	B	X		C	C	
	C5-4	005	F	X			C	
		006	F	X			C	
		007	M	X		C	C	
		008	F	X		C	C	
		009	M	X		C	C	
	C4-4	010	F	X		C	C	
	B4-6	011	F	X		C		
		AlSi05	F	X		N	N	
		AlSi06	F	X			N	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1451	G.O. Area (mm2):	0.01	Date:	2/3/2020
Client Sample I.D.:	Test A - Pump 2	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	30	Grid Box:	016G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	1 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
A6	K3-6	NSD								
	K3-3	NSD								
	K4-1	NSD								
	K4-4	NSD								
	K4-6	NSD								
	K4-3	NSD								
	K5-1	NSD								
	K5-4	NSD								
	H5-4	NSD								
	H4-6	NSD								
	H4-4	NSD								
	H4-1	NSD								
	H3-3	NSD								
	H3-6	NSD								
A7	B3-1	NSD								
	B3-4	NSD								
	B2-6	NSD								
	C2-4	NSD								
	C2-6	NSD								
	C3-1	NSD								
	E2-1	NSD								
	E5-4	NSD								
	F4-6	NSD								
	F4-1	NSD								
	F3-3	NSD								
	G3-6	NSD								
	K4-3	NSD								
B6	H5-1	NSD								
	H4-6	NSD								
	G4-1	NSD								
	G5-3	NSD								
	G6-4	NSD								
	F6-4	NSD								
	F4-6	NSD								
	E3-6	NSD								
	C2-6	NSD								
	C3-3	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1451	G.O. Area (mm2):	0.01	Date:	2/3/2020
Client Sample I.D.:	Test A - Pump 2	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	30	Grid Box:	016G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	2 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
B6	C4-3	1	B	7.5	0.40	C	C		7.1	0.38
	C5-4	NSD								
	B5-4	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	30	**Analyst:**	MRU
Lab Sample I.D.:	AE1451	**Grid Opening (mm^2):**	0.01	**Date:**	1/2/20-1/6/20
Client Sample I.D.:	Test A – P2	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
E1	H4-4	NSD						
	H5-1	001	F	X			C	
		AlSi01	B	X		N	N	
	G4-4	AlSi02	F		X	N	N	
	G3-4	002	F	X		C	C	
		003	M	X			C	
		004	M	X		C	C	
	F3-3	NSD						
D1	B3-4	005	M	X		C	C	
	C4-4	006	F	X		C	C	
	C3-3	007	M	X		C	C	
	E3-1	008	B	X		C	C	
		009	B	X		C		
	E4-4	010	M	X		C		

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	34-42	**Analyst:**	MRU
Lab Sample I.D.:	AE1452	**Grid Opening (mm^2):**	0.01	**Date:**	1/6/2020
Client Sample I.D.:	Test A – P3	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
B5	K5-6	AlStr01	M	X		N	N	
		Al-SiStr02	B	X		N	N	
	K4-1	NSD						
	K3-3	NSD						
	H3-3	001	M	X		C	C	
		002	M	X		C	C	
	H4-3	NSD						
B4	K4-6	NSD						
	K3-4	003	F	X		C	C	
	H3-3	NSD						
	H4-4	NSD						
	G4-3	004	M	X		C	C	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	43	**Analyst:**	MRU
Lab Sample I.D.:	AE1453	**Grid Opening (mm^2):**	0.01	**Date:**	1/6/20-1/7/20
Client Sample I.D.:	Test A – P4	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
A5	E3-6	NSD						
	E4-3	NSD						
	E5-1	001	M	X			C	
	F5-4	002	M	X			C	
		AlStr001	M	X		N	N	
		AlStr002	M	X		N	N	
		AlStr003	M	X			N	
	F4-4	NSD						
A4	G4-3	NSD						
	F4-3	NSD						
	E5-4	003	M	X		C	C	
	E4-4	NSD						
	E3-3	NSD						

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	76	**Analyst:**	MRU
Lab Sample I.D.:	AE1454	**Grid Opening (mm^2):**	0.01	**Date:**	1/7/2020
Client Sample I.D.:	Test A – P5	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
A1	K3-4	Al-Si01	M		X	N	N	
		Al-Si02	B	X			N	
	H6-1	NSD						
	H5-1	Al-Si03	B	X		N		
	H4-3	NSD						
	G3-1	NSD						
A2	K5-1	NSD						
	K4-1	NSD						
	H3-3	NSD						
	H4-4	Al-Si04	B	X			N	
		Al-S-05	M	X			N	
	G4-3	NSD						
	G3-3	NSD						

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	31	**Analyst:**	MRU
Lab Sample I.D.:	AE1455	**Grid Opening (mm^2):**	0.01	**Date:**	1/7/2020
Client Sample I.D.:	Between A&B	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
A6	C3-3	NSD						
	C4-4	NSD						
	E5-6	NSD						
	E4-4	NSD						
	E3-3	NSD						
A7	K3-4	NSD						
	K4-4	NSD						
	K5-1	NSD						
	H4-4	NSD						
	H3-3	AIStr01	B	X		N	N	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1456	G.O. Area (mm2):	0.01	Date:	11/12/2019
Client Sample I.D.:	Test B - Pump 1	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	31	Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	1 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
D10	K3-3	NSD								
	K4-3	NSD								
	K5-1	NSD								
	H5-3	NSD								
	H4-6	NSD								
	H3-3	NSD								
	H2-6	1	F	19.0	2.00		N		18.1	1.90
	G2-3	1.5	F	80.0	4.00		N		76.2	3.81
	G3-4	NSD								
	G4-1	NSD								
	G4-6	NSD								
	G5-3	NSD						Chrys <5		
	H6-1	2	B	50.5	0.50	C	C		48.1	0.48
		3	C	14.0	0.50	C	C		13.3	0.48
		4	B	25.0	0.30	C	C		23.8	0.29
	G6-6	NSD								
D9	H6-1	NSD								
	H5-1	NSD								
	H4-6	NSD								
	H4-4	NSD								
	H3-3	NSD								
	G3-3	NSD								
	G4-4	NSD								
	G5-6	NSD								
	G6-3	NSD								
	F6-1	NSD								
	F5-1	NSD								
	F4-1	NSD								
	F3-1	NSD								
D8	K4-4	NSD						Chrys <5		
	K3-3	NSD								
	H2-3	NSD								
	H3-6	NSD								
	H4-4	NSD								
	H5-4	NSD						Chrys <5		
	H6-4	NSD								
	G6-4	NSD						Chrys <5		

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1456	G.O. Area (mm2):	0.01	Date:	11/12/2019
Client Sample I.D.:	Test B - Pump 1	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	31	Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	2 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
D8	G5-4	NSD								
	G4-1	5	F	6.9	0.80		N		6.6	0.76
	G3-6	NSD								
	F3-1	NSD								
	F5-6	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	31	**Analyst:**	MRU
Lab Sample I.D.:	AE1456	**Grid Opening (mm^2):**	0.01	**Date:**	1/7/2020
Client Sample I.D.:	Test B – P1	**Filter Area (mm^2):**	385	**Comments:**	013G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
D10	K3-3	001	C	X		C	C	
		002	C	X			C	
		003	M	X			C	
	H4-3	NSD						
	H3-3	004	C	X		C	C	
		005	C	X		C	C	
	H2-4	NSD						
	G4-6	006	M	X			C	
D9	C6-6	007	C	X			C	
	C5-4	NSD						
	C4-6	NSD						
	E3-3	NSD						
	F5-1	008	C	X			C	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1457	G.O. Area (mm2):	0.01	Date:	2/3/2020
Client Sample I.D.:	Test B - Pump 2	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	30	Grid Box:	016G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	1 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
A1	B5-3	NSD								
	B5-1	NSD								
	B4-4	NSD								
	B3-6	NSD								
	C3-3	NSD								
	C4-1	NSD								
	C4-3	NSD								
	C5-6	NSD								
	C6-3	NSD								
	E6-1	NSD								
	E5-4	NSD								
	E4-3	NSD								
	F4-3	NSD								
	G5-3	1	1	10.5	1.20	N	N		10.0	1.14
A2	A5-4	NSD								
	A4-6	NSD								
	B4-3	NSD								
	B5-4	NSD								
	B5-3	NSD								
	C6-1	NSD								
	C5-6	NSD								
	C5-4	NSD								
	C4-3	NSD								
	E4-3	NSD								
	E5-6	2	2	5.3	0.75	C	C		5.0	0.71
	E6-4	NSD								
	F5-3	3	3	8.5	1.10	N	N		8.1	1.05
A3	H2-6	NSD								
	H3-6	NSD								
	H4-3	NSD								
	G6-1	NSD								
	G5-3	NSD								
	G4-3	NSD								
	G3-4	NSD								
	F3-1	NSD								
	F4-1	NSD								
	F5-4	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1457	G.O. Area (mm2):	0.01	Date:	2/3/2020
Client Sample I.D.:	Test B - Pump 2	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	30	Grid Box:	016G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	2 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
A3	E6-4	NSD								
	E4-4	NSD								
	C4-1	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected
**On Screen Measurement
*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)
Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix
SAED: C = Chrysotile, A = Amphibole
EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	30	**Analyst:**	MRU
Lab Sample I.D.:	AE1457	**Grid Opening (mm^2):**	0.01	**Date:**	1/7-1/16/20
Client Sample I.D.:	Test B – P2	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
B6	K4-4	001	M		X	C	C	
		002	B	X		C	C	
	K5-3	003	B	X		C		Close to gridbar
	H6-1	NSD						
	H5-4	004	M	X		C	C	
		005	B	X		C	C	
	G4-4	006	F	X			C	
		007	C	X			C	
B7	B5-4	AlSi01	M	X		N	N	
	B4-4	008	M	X		C		
		009	M	X			C	
	C3-3	010	M		X	C	C	
		011	F	X			C	
		012	M	X			C	
		013	M	X			C	
		014	M	X			C	
	C4-4	015	M	X			C	
	E4-4	016	B	X			C	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	34-42	**Analyst:**	MRU
Lab Sample I.D.:	AE1458	**Grid Opening (mm^2):**	0.01	**Date:**	1/16/20
Client Sample I.D.:	Test B – P3	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 2
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
C6	G4-4	001	F	X			C	
		002	M	X		C	C	
	G3-3	003	M	X			C	
		004	M	X			C	
		005	M	X			C	
		006	F	X		C	C	
	F2-3	007	M	X			C	
		008	F	X		C	C	
	F3-3	SiAlStr01	F		X	N	N	
		009	M	X			C	
		010	C	X		C	C	
		011	F	X			C	
	E4-4	012	M	X			C	
		013	C	X			C	
		014	M		X	C	C	
C7	H3-1	015	B	X			C	
		016	F	X			C	
		017	B	X				
		018	M	X			C	
	H4-4	019	B	X			C	
		020	B	X			C	
	G4-4	021	M	X			C	
		022	M	X			C	
	G3-3	NSD						
	F3-3	Al-SiStr02	F	X		N	N	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	34-42	**Analyst:**	MRU
Lab Sample I.D.:	AE1458	**Grid Opening (mm^2):**	0.01	**Date:**	1/16/20
Client Sample I.D.:	Test B – P3	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	2 of 2
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
C7	F3-3	023	M	X			C	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	43	**Analyst:**	MRU
Lab Sample I.D.:	AE1459	**Grid Opening (mm^2):**	0.01	**Date:**	1/16 – 1/17/20
Client Sample I.D.:	Test B – P4	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
D6	K4-4	001	M	X		C	C	
	K5-4	002	B	X		C	C	
		003	M	X			C	
		004	M	X			C	
	H5-4	005	M	X			C	
	H4-6	006	M	X			C	
		007	M	X		C	C	
		008	B	X			C	
		009	M	X		C	C	
	G4-4	010	B	X			C	
		AlSi01	F	X		N	N	
D7	C5-4	AlSi02	F	X		N	N	
	C4-4	011	M	X			C	
		012	M	X			C	
	E3-3	013	F	X			C	
	E4-4	AlSi03	M	X			N	
		014	M	X			C	
	F3-3	015	C	X			C	
		016	M	X			C	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	76	**Analyst:**	MRU
Lab Sample I.D.:	AE1460	**Grid Opening (mm^2):**	0.01	**Date:**	1/17/20
Client Sample I.D.:	Test B – P5	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
E6	E4-4	Al-Si01	M	X			N	
	E3-4	Al-Si02	M	X			N	
	F3-3	NSD						
	F4-4	NSD						
	G4-1	NSD						
E7	G4-4	NSD						
	G3-4	Al-Si03	M	X			N	
	F3-3	NSD						
	F4-4	NSD						
	E4-4	NSD						

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	31	**Analyst:**	MRU
Lab Sample I.D.:	AE1461	**Grid Opening (mm^2):**	0.01	**Date:**	1/17/20
Client Sample I.D.:	Between B&C	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
A9	C4-4	NSD						
	E5-6	NSD						
	E4-4	001	F	X		C	C	
	E3-4	NSD						
	F3-3	NSD						
B9	C5-4	002	M	X		C	C	
	C4-4	003	M		X	C	C	
		004	M	X		C	C	
	E3-6	NSD						
	E4-6	Al-Si 01	B	X			N	
	F5-1	005	M	X			C	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1462	G.O. Area (mm2):	0.01	Date:	11/12/19 - 11/13/19
Client Sample I.D.:	Test C - Pump 1	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	31	Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	1 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
C10	H2-3	NSD								
	H3-1	0.5	F	10.0	0.30		N	Chrys <5µm	9.5	0.29
	H3-6	NSD								
	H4-3	NSD								
	H5-4	NSD								
	H6-1	NSD								
	G6-1	NSD						Chrys <0.25µm W		
	G5-4	1.5	F	5.9	0.30		N		5.6	0.29
	G4-3	NSD								
	G3-1	NSD								
	F3-3	NSD								
	F4-3	NSD								
	F5-3	NSD								
	F6-1	NSD								
C9	C2-3	NSD						Chrys <5µm		
	C3-1	NSD						Chrys <0.25µm W		
	C4-3	NSD								
	C5-4	2	F	75.0	0.30		N		71.4	0.29
	C6-4	NSD								
	E6-4	NSD						Chrys <5µm		
	E4-4	NSD								
	E3-1	NSD								
	E2-6	NSD								
	F2-6	3	C	7.5	0.50	C	C		7.1	0.48
	F4-4	NSD								
	F5-4	NSD								
	G3-1	NSD								
C8	B3-6	NSD								
	B4-6	NSD								
	B5-4	NSD								
	C5-1	NSD								
	C4-4	NSD								
	C3-3	NSD								
	C2-6	NSD								
	E3-3	NSD								
	E4-4	NSD								
	E5-6	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1462	G.O. Area (mm2):	0.01	Date:	11/12/19 - 11/13/19
Client Sample I.D.:	Test C - Pump 1	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	31	Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	2 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
C8	F5-4	NSD								
	F4-4	NSD								
	F3-3	NSD								
C8	B3-6	NSD								
	B4-6	NSD								
	B5-4	NSD								
	C5-1	NSD								
	C4-4	NSD								
	C3-3	NSD								
	C2-6	NSD								
	E3-3	NSD								
	E4-4	NSD								
	E5-6	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	31	**Analyst:**	MRU
Lab Sample I.D.:	AE1462	**Grid Opening (mm^2):**	0.01	**Date:**	1/20/20
Client Sample I.D.:	Test C – P1	**Filter Area (mm^2):**	385	**Comments:**	013G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 2
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
C10	G5-4	Al-Si01	F	X		N	N	
	G2-3	Al-Si02	F	X		N	N	
		Al-Si03	F	X		N	N	
		001	M	X			C	
		Al-Si04	F		X	N	N	
	F2-6	002	M	X			C	
		003	M	X			C	
		004	M	X		C	C	
	F3-6	005	M	X		C	C	
		006	M	X		C	C	
		007	M	X		C	C	
		008	M	X			C	
	E5-1	009	M	X			C	
		010	B	X			C	
C9	C4-3	011	B		X	C	C	
		012	M	X			C	
		013	M	X			C	
		Al-Si05	F	X		N	N	
		014	M	X			C	
		015	F		X		C	
	C5-6	Al-Si06	F	X			N	
	C6-4	016	M	X			C	
	E5-6	017	F	X			C	
	E4-1	018	M	X			C	
		019	M	X			C	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	31	**Analyst:**	MRU
Lab Sample I.D.:	AE1462	**Grid Opening (mm^2):**	0.01	**Date:**	1/20/20
Client Sample I.D.:	Test C – P1	**Filter Area (mm^2):**	385	**Comments:**	013G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	2 of 2
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
C9	E4-1	020	M	X			C	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1463	G.O. Area (mm2):	0.01	Date:	2/3/2020 - 2/4/2020
Client Sample I.D.:	Test C - Pump 2	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	30	Grid Box:	016G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	1 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
B1	E3-4	NSD								
	F4-4	NSD								
	F3-4	1	B	8.1	0.60	C	C		7.7	0.57
	F2-1	NSD								
	G2-6	NSD								
	G3-3	NSD								
	H4-6	NSD								
	H3-1	NSD								
	H2-3	NSD								
	H2-6	NSD								
	K2-3	NSD								
	K3-1	NSD								
	K4-3	NSD								
	K6-1	NSD								
B2	C3-4	2	F	12.0	0.30	N	N		11.4	0.29
	E2-6	NSD								
	E3-4	NSD								
	G2-3	NSD								
	G4-4	NSD								
	G4-6	NSD								
	H5-4	NSD								
	H4-6	NSD								
	H4-4	NSD								
	K3-6	NSD								
	K4-4	NSD								
	K4-1	NSD								
	K4-6	NSD								
B3	C5-6	NSD								
	E5-4	NSD								
	E4-3	NSD								
	E4-6	NSD								
	G2-4	NSD								
	H2-1	3	B	21.5	0.30	N	N		20.5	0.29
	H3-4	NSD								
	H5-4	NSD								
	H6-1	NSD								
	K3-6	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1463	G.O. Area (mm2):	0.01	Date:	2/3/2020 - 2/4/2020
Client Sample I.D.:	Test C - Pump 2	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	30	Grid Box:	016G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	2 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
B3	K3-4	NSD								
	K3-1	NSD								
	K2-6	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected
**On Screen Measurement
*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)
Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix
SAED: C = Chrysotile, A = Amphibole
EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	30	**Analyst:**	MRU
Lab Sample I.D.:	AE1463	**Grid Opening (mm^2):**	0.01	**Date:**	1/20/20
Client Sample I.D.:	Test C – P2	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
A10	B3-4	Al-Si01	F		X	N	N	
	C2-6	001	F	X		C	C	
		002	M	X		C	C	
	C3-3	Al-Si02	F		X		N	
		003	M	X		C	C	
	C4-4	NSD						
	E3-1	004	M	X		C	C	
		005	F	X			C	
		006	M	X			C	
B10	K4-4	NSD						
	H3-3	007	M	X			C	
		008	M	X			C	
	H4-6	NSD						
	H5-6	009	F	X			C	
		010	F	X			C	
		011	M	X			C	
	G4-4	012	M	X			C	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	34-42	**Analyst:**	MRU
Lab Sample I.D.:	AE1464	**Grid Opening (mm^2):**	0.01	**Date:**	1/21/20
Client Sample I.D.:	Test C – P3	**Filter Area (mm^2):**	385	**Comments:**	015G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
E10	H3-3	001	M	X			C	
	H4-3	SiStr01	M	X		N	N	
		002	M	X		C	C	
	G5-4	SiStr02	F		X	N	N	
		003	B	X		C	C	
		004	M	X		C	C	
	G4-1	SiStr03	F		X	N	N	
	F3-6	Al-SiStr04	X	X			N	
		005	B		X	C	C	
		Al-SiStr05	F	X			N	
D10	E4-4	006	M	X			C	
		Al-SiStr06	F		X		N	
		007	M	X			C	
		Al-SiStr07	F		X		N	
	E5-4	008	M	X			C	
	F6-6	009	M	X			C	
	F5-6	010	F	X			C	
		011	M	X			C	
		Al-SiStr08	F	X			N	
		Al-SiStr09	M	X			N	
		Al-SiStr10	M	X		N	N	
	G4-6	Al-SiStr11	F	X			N	
		012	M	X			C	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	43	**Analyst:**	MRU
Lab Sample I.D.:	AE1465	**Grid Opening (mm^2):**	0.01	**Date:**	1/21/20
Client Sample I.D.:	Test C – P4	**Filter Area (mm^2):**	385	**Comments:**	016G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 2
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
E10	H4-4	001	M	X		C	C	
		Al-Si01	F		X		N	
	H3-3	002	M	X		C	C	
		003	M	X		C	C	
	G3-3	004	M	X		C	C	
		005	M	X			C	
	G4-4	Al-Si02	F	X			N	
		006	F	X			C	
		Al-Si03	F	X			N	
		Al-Si04	F	X			N	
	F4-3	Al-Si05	F		X		N	
		Al-Si06	M	X			N	
E9	E4-3	007	M	X			C	
		008	F	X			C	
		009	M	X			C	
	E5-3	Al-Si07	F		X		N	
		Al-Si08	F	X			N	
	F5-6	Al-Si09	F		X		N	
		010	M	X			C	
		Al-Si10	F	X			N	
		011	F	X			C	
		012	M	X			C	
	F4-3	013	M	X			C	
		014	B	X			C	
		Si11	F		X		N	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	43	**Analyst:**	MRU
Lab Sample I.D.:	AE1465	**Grid Opening (mm^2):**	0.01	**Date:**	1/21/20
Client Sample I.D.:	Test C – P4	**Filter Area (mm^2):**	385	**Comments:**	016G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	2 of 2
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
E9	G5-4	Si12	F	X			N	
		Al-Si13	F		X		N	
		015	B	X			C	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	76	**Analyst:**	MRU
Lab Sample I.D.:	AE1466	**Grid Opening (mm^2):**	0.01	**Date:**	1/20/20
Client Sample I.D.:	Test C – P5	**Filter Area (mm^2):**	385	**Comments:**	016G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
D10	B4-6	NSD						
	C4-6	NSD						
	C5-4	NSD						
	E6-6	NSD						
	E5-4	NSD						
D9	H5-6	NSD						
	H4-4	Al-Si01	F	X			N	
		Al-Si02	F	X			N	
	G4-6	Al-Si03	F	X			N	
	G5-3	NSD						
	F5-4	Al-Si04	F	X			N	

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
Air Sample Analysis Sheet

MVA Project# 13129 | Amount Collected(L): 31 | Analyst: JMS
MVA Sample# AE1467 | Grid Opening (mm2): 0.01 | Date: 1/14 - 1/15/20
Client I.D.: Between C&D | Filter Area (mm2): 385 | Page: 1 of 1
Instrument: Philips CM120 | Filter Type: MCE | Comments:
Magnification: 23,900 | Openings Analyzed: 10 | Method: ISO 10312 x
Acc. Voltage: 100kV | Level of Analysis: CMQ (C) | or ASTM D6281
Level of Analysis: N/A (A)

Grid	Opening	Number of Structures Primary	Number of Structures Total	Class	Structure Type	Length* (cm)	Width* (cm)	Comments	Length** (µm)	Width** (µm)
C10	B5-1	1			MD10	5.7	1.60	SAED observed,	2.4	0.67
			1	CMQ	MF	5.7	0.20	unable to image	2.4	0.08
	C4-3	NSD								
	E5-4	NSD								
	E5-3	2			MD10	8.9	0.50	unable to observe	3.7	0.21
			2	CMQ	MF	8.9	0.10	SAED pattern	3.7	0.04
	G5-1	NSD								
C9	C6-4	NSD								
	C5-4	NSD								
	E3-6	3	3	CMQ	F	2.1	0.20	no SAED observed	0.9	0.08
	G3-3	NSD								
	K3-6	NSD								

*On Screen Measurement
** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1468	G.O. Area (mm2):	0.01	Date:	11/13/19 - 11/14/19
Client Sample I.D.:	Test D - Pump 1	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	33	Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	1 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
B10	B2-3	NSD								
	B3-6	1		5.8	0.50		N		5.5	0.48
	B4-4	NSD								
	B5-1	NSD								
	C5-3	NSD								
	C4-6	NSD								
	C3-3	NSD						Chrys <5µm		
	E3-4	NSD								
	E4-4	NSD								
	E5-3	NSD								
	F5-4	NSD								
	F4-6	NSD								
	F3-3	NSD								
	G4-1	NSD								
B9	C2-4	NSD								
	C3-6	NSD								
	C4-4	NSD								
	E4-3	NSD								
	E3-4	NSD								
	E2-3	2	C	17.0	0.80	C	C	Coated with GSR	16.2	0.76
	F2-3	NSD								
	F3-6	NSD								
	F4-4	NSD								
	F5-6	NSD								
	F6-4	NSD								
	G5-3	NSD								
	G4-4	NSD								
B8	E3-6	NSD								
	E4-4	NSD								
	E5-6	3	F	5.2	0.50		N	Chrys <.25µm Diam.	5.0	0.48
	E6-4	NSD								
	F6-1	NSD								
	F5-6	NSD								
	F4-1	NSD								
	F3-6	NSD								
	G2-3	NSD								
	G3-4	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1468	G.O. Area (mm2):	0.01	Date:	11/13/19 - 11/14/19
Client Sample I.D.:	Test D - Pump 1	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	33	Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	2 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
B8	G4-1	NSD								
	G4-6	NSD								
	H4-1	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
Air Sample Analysis Sheet

MVA Project# 13129 | Amount Collected(L): 33 | Analyst: MRU
MVA Sample# AE1468 | Grid Opening (mm2): 0.01 | Date: 1/27/2020 - 1/28/2020
Client I.D.: Test D - P2 | Filter Area (mm2): 385 | Page: 1 of 2
Instrument: Philips EM420 | Filter Type: MCE | Comments: 013G19
Magnification: 21,200 | Openings Analyzed: 10 | Method: ISO 10312
Acc. Voltage: 100kV | Level of Analysis: CDQ (C) | or ASTM D6281
Level of Analysis: N/A (A)

Grid	Opening	Number of Structures Primary	Number of Structures Total	Class	Structure Type	Length* (cm)	Width* (cm)	Comments	Length** (µm)	Width** (µm)
B10	C3-3	1		NAM	MD11	55.5	4.00		26.2	1.89
			1	NAM	MF	55.5	0.20		26.2	0.09
		2		CDQ	CD+0	14.0	12.00		6.6	5.66
			2	CDQ	CB	2.6	0.20		1.2	0.09
			3	CDQ	CB	2.5	0.30		1.2	0.14
			4	CMQ	CB	2.2	0.20		1.0	0.09
			5	CMQ	CF	1.4	0.15		0.7	0.07
			6	CMQ	CF	1.2	0.20		0.6	0.09
			7	CMQ	CR+0	12.5	8.50		5.9	4.01
		3		NAM	MD10	8.0	4.80		3.8	2.26
			8	NAM	MF	4.2	0.30		2.0	0.14
		4		NAM	MD10	3.0	2.60		1.4	1.23
			9	NAM	MF	3.0	0.40		1.4	0.19
	E3-3	5	10	NAM	F	8.0	0.60		3.8	0.28
		6	11	NAM	F	17.3	0.20		8.2	0.09
		7	12	NAM	B	2.0	0.25		0.9	0.12
	E4-3	8	13	NAM	B	147.0	1.00		69.3	0.47
		9	14	CMQ	B	14.2	0.10		6.7	0.05
		10	15	NAM	CC+0	7.5	0.20		3.5	0.09
	F5-6	11	16	NAM	CC+1	35.0	15.00		16.5	7.08
	F4-4	12		CDQ	MD10	7.5	2.80		3.5	1.32
			17	CDQ	MB	5.0	0.30	Coated in GSR	2.4	0.14
		13	18	NAM	F	3.0	0.20		1.4	0.09
		14		CDQ	MD10	2.3	1.20		1.1	0.57
			19	CDQ	MF	2.0	0.10		0.9	0.05
B9	B4-4	15	20	NAM	F	3.6	0.40		1.7	0.19
		16	21	NAM	F	6.7	0.20		3.2	0.09
		17		CDQ	MD30	5.2	3.10		2.5	1.46
			22	CDQ	MB	2.5	0.30		1.2	0.14
			23	CMQ	MB	2.0	0.10		0.9	0.05
			24	CMQ	MB	1.9	0.10		0.9	0.05
		18	25	NAM	F	2.0	0.10		0.9	0.05
	B5-4	19	26	CDQ	B	8.5	0.30		4.0	0.14
		20		CMQ	MD10	1.9	1.40		0.9	0.66
			27	CMQ	MF	1.7	0.10		0.8	0.05
		21	28	NAM	F	17.0	0.20		8.0	0.09
		22	29	NAM	F	6.8	0.30		3.2	0.14
		23		CMQ	MD10	8.3	5.30		3.9	2.50

*On Screen Measurement
** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

MVA SCIENTIFIC CONSULTANTS
Air Sample Analysis Sheet

MVA Project# 13129 | Amount Collected(L): 33 | Analyst: MRU
MVA Sample# AE1468 | Grid Opening (mm2): 0.01 | Date: 1/27/2020 - 1/28/2020
Client I.D.: Test D - P2 | Filter Area (mm2): 385 | Page: 2 of 2
Instrument: Philips EM420 | Filter Type: MCE | Comments: 013G19
Magnification: 21,200 | Openings Analyzed: 10 | Method: ISO 10312
Acc. Voltage: 100kV | Level of Analysis: CDQ (C) | or ASTM D6281
Level of Analysis: N/A (A)

Grid	Opening	Number of Structures Primary	Number of Structures Total	Class	Structure Type	Length* (cm)	Width* (cm)	Comments	Length** (µm)	Width** (µm)
B9	B5-4	23	30	CMQ	MF	8.2	0.10		3.9	0.05
	C5-4	24	31	NAM	F	35.2	0.20		16.6	0.09
	C4-4	25	32	NAM	F	27.5	0.20		13.0	0.09
		26	33	NAM	F	11.8	0.60		5.6	0.28
	F5-4	27	34	NAM	B	26.0	0.20		12.3	0.09
		28	35	NAM	B	48.0	0.50		22.6	0.24
		29	36	NAM	B	23.3	0.40		11.0	0.19
		30	37	NAM	F	12.5	0.10		5.9	0.05
		31		CDQ	MD10	4.1	1.50		1.9	0.71
			38	CDQ	MB	3.7	0.20		1.7	0.09
		32		CMQ	MD10	3.7	1.30		1.7	0.61
			39	CMQ	MF	2.8	0.10		1.3	0.05

*On Screen Measurement
** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1469	G.O. Area (mm2):	0.01	Date:	2/4/2020
Client Sample I.D.:	Test D - Pump 2	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	32	Grid Box:	016G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	1 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
C1	K4-1	NSD								
	H2-6	NSD								
	H3-1	NSD								
	H4-4	0.5	B	25.5	0.30	N	N		24.3	0.29
	G5-3	NSD								
	G4-6	NSD								
	G3-3	1.5	B	43.8	0.30	N	N		41.7	0.29
	G2-3	NSD								
	F3-6	NSD								
	F5-4	2.5	B	6.0	0.30	N	N		5.7	0.29
	F6-4	NSD								
	E5-6	NSD								
	E3-4	NSD								
	C5-6	NSD								
C2	B3-6	NSD								
	C5-1	NSD								
	C4-4	NSD								
	C3-6	NSD								
	E2-6	NSD								
	E3-3	NSD								
	F4-3	3.5	B	9.7	0.80	C	C		9.2	0.76
	F3-3	NSD								
	F2-3	NSD								
	G2-6	NSD								
	G3-1	NSD								
	G5-6	NSD								
	H4-1	4.5	B	7.0	0.60	N	N		6.7	0.57
C3	B3-4	NSD								
	B5-1	NSD								
	C4-4	NSD								
	C3-4	NSD								
	E2-1	NSD								
	E4-3	NSD								
	F5-1	NSD								
	H2-4	NSD								
	H3-4	NSD								
	H4-1	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1469	G.O. Area (mm2):	0.01	Date:	2/4/2020
Client Sample I.D.:	Test D - Pump 2	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	32	Grid Box:	016G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	2 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
C3	K4-4	NSD								
	K3-6	NSD								
	K2-3	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
Air Sample Analysis Sheet

MVA Project# 13129 | Amount Collected(L): 32 | Analyst: JMS
MVA Sample# AE1469 | Grid Opening (mm2): 0.01 | Date: 1/21 - 1/27/20
Client I.D.: TD, P2 | Filter Area (mm2): 385 | Page: 1 of 2
Instrument: Philips CM120 | Filter Type: MCE | Comments:
Magnification: 23,100 | Openings Analyzed: 10 | Method: ISO 10312 x
Acc. Voltage: 100kV | Level of Analysis: CMQ (C) | or ASTM D6281
Level of Analysis: N/A (A)

Grid	Opening	Number of Structures Primary	Total	Class	Structure Type	Length* (cm)	Width* (cm)	Comments	Length** (µm)	Width** (µm)
B10	B3-6	1		NAM	MD11	46.2	3.20		20.0	1.39
			1	NAM	MB	46.2	0.40		20.0	0.17
		2		NAM	MD11	33.2	3.60		14.4	1.56
			2	NAM	MB	33.2	0.30		14.4	0.13
		3		CMQ	MD11	18.1	2.20	unable to observe	7.8	0.95
			3	CMQ	MB	18.1	0.20	SAED pattern	7.8	0.09
		4		NAM	MD11	18.6	4.40		8.1	1.90
			4	NAM	MB	18.6	0.40		8.1	0.17
		5		NAM	MD11	25.3	2.90		11.0	1.26
			5	NAM	MF	25.3	0.30		11.0	0.13
	E2-3	6		CMQ	MD11	10.4	4.10	unable to observe	4.5	1.77
			6	CMQ	MF	10.4	0.20	SAED pattern	4.5	0.09
		7		NAM	MD11	35.6	3.10		15.4	1.34
			7	NAM	MF	35.6	0.40		15.4	0.17
		8		NAM	MD11	27.7	2.00		12.0	0.87
			8	NAM	MF	27.7	0.60		12.0	0.26
	F3-1	9		NAM	MD11	182.8	5.30		79.1	2.29
			9	NAM	MF	182.8	0.50		79.1	0.22
		10		NAM	MD10	8.5	1.10		3.7	0.48
			10	NAM	MF	8.5	0.20		3.7	0.09
		11		NAM	MD10	8.7	1.30		3.8	0.56
			11	NAM	MF	8.7	0.40		3.8	0.17
	F5-6	12		NAM	MD10	7.0	1.90		3.0	0.82
			12	NAM	MF	7.0	0.40		3.0	0.17
		13		CMQ	MD10	4.0	3.10	unable to observe	1.7	1.34
			13	CMQ	MF	4.0	0.20	SAED pattern	1.7	0.09
		14		NAM	MD11	56.3	3.00		24.4	1.30
			14	NAM	MF	56.3	0.30		24.4	0.13
	C5-4	15		NAM	MD11	60.7	13.70		26.3	5.93
			15	NAM	MF	60.7	0.30		26.3	0.13
		16		NAM	MD10	8.5	4.90		3.7	2.12
			16	NAM	MF	8.5	0.70		3.7	0.30
		17		NAM	MD11	43.1	2.90		18.7	1.26
			17	NAM	MF	43.1	0.30		18.7	0.13
		18		CMQ	MD10	2.1	1.10		0.9	0.48
			18	CMQ	MF	2.1	0.30		0.9	0.13
B9	E2-3	19		NAM	MD10	31.9	3.90		13.8	1.69
			19	NAM	MF	31.9	0.20		13.8	0.09

*On Screen Measurement

** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

MVA SCIENTIFIC CONSULTANTS
Air Sample Analysis Sheet

MVA Project# 13129 | Amount Collected(L): 32 | Analyst: JMS
MVA Sample# AE1469 | Grid Opening (mm2): 0.01 | Date: 1/21 - 1/27/20
Client I.D.: TD, P2 | Filter Area (mm2): 385 | Page: 2 of 2
Instrument: Philips CM120 | Filter Type: MCE | Comments:
Magnification: 23,100 | Openings Analyzed: 10 | Method: ISO 10312 x
Acc. Voltage: 100kV | Level of Analysis: CMQ (C) | or ASTM D6281
Level of Analysis: N/A (A)

Grid	Opening	Number of Structures Primary	Total	Class	Structure Type	Length* (cm)	Width* (cm)	Comments	Length** (µm)	Width** (µm)
B9	E2-3	20		NAM	MD11	87.0	7.10		37.7	3.07
			20	NAM	MF	87.0	0.20		37.7	0.09
		21		CMQ	MD11	18.4	2.40	unable to observe	8.0	1.04
			21	CMQ	MF	18.4	0.30	SAED pattern	8.0	0.13
	C4-1	22		NAM	MD11	49.9	7.20		21.6	3.12
			22	NAM	MF	49.9	0.30		21.6	0.13
		23		NAM	MD10	8.4	1.00		3.6	0.43
			23	NAM	MF	8.4	0.30		3.6	0.13
		24		NAM	MD10	11.4	1.30		4.9	0.56
			24	NAM	MF	11.4	0.40		4.9	0.17
	C5-4	25		NAM	MD11	11.5	1.10		5.0	0.48
			25	NAM	MF	11.5	0.10		5.0	0.04
		26		CMQ	MD11	17.3	2.50	unable to observe	7.5	1.08
			26	CMQ	MF	17.3	0.10	SAED pattern	7.5	0.04
	H5-1	27		NAM	MD10	13.0	2.10		5.6	0.91
			27	NAM	MF	13.0	0.20		5.6	0.09
	H3-1	28		NAM	MD11	30.1	4.60		13.0	1.99
			28	NAM	MF	30.1	0.10		13.0	0.04
		29		NAM	MD11	110.0	2.30	Fiber wraps around	47.6	1.00
			29	NAM	MF	110.0	0.30	difficult to measure	47.6	0.13
		30		NAM	MD11	84.1	3.90		36.4	1.69
			30	NAM	MF	84.1	0.30		36.4	0.13
		31		NAM	MD11	64.9	2.90		28.1	1.26
			31	NAM	MF	64.9	0.40		28.1	0.17
		32		NAM	MD11	18.0	2.90		7.8	1.26
			32	NAM	MF	18.0	0.50		7.8	0.22

*On Screen Measurement
** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

MVA SCIENTIFIC CONSULTANTS
Air Sample Analysis Sheet

Project# 13129 | Amount Collected(L): 36 - 44 | Analyst: MRU
ample# AE1470 | Grid Opening (mm2): 0.01 | Date: 1/28/2020
ent I.D.: Test D P3 | Filter Area (mm2): 385 | Page: 1 of 1
rument: Philips EM120 | Filter Type: MCE | Comments: 016G19
fication: 21,200 | Openings Analyzed: 10 | Method: ISO 10312
/oltage: 100kV | Level of Analysis: CDQ (C) | or ASTM D6281
Level of Analysis: N/A (A)

Opening	Number of Structures Primary	Total	Class	Structure Type	Length* (cm)	Width* (cm)	Comments	Length** (µm)	Width** (µm)
B4-4	1	1	NAM	B	16.5	0.50		7.8	0.24
	2		CMQ	MD10	3.8	1.50		1.8	0.71
		2	CMQ	MF	3.8	0.15		1.8	0.07
	3	3	NAM	F	20.2	0.20		9.5	0.09
	4	4	NAM	F	27.5	0.60		13.0	0.28
C3-6	5		CDQ	MD20	6.3	3.00		3.0	1.42
		5	CDQ	MF	3.9	0.15		1.8	0.07
		6	CMQ	MB	2.3	0.30		1.1	0.14
	6	7	NAM	B	69.5	0.75		32.8	0.35
C4-6	7	8	NAM	F	37.0	0.30		17.5	0.14
	8	9	NAM	F	75.5	0.20		35.6	0.09
E4-4	9	10	NAM	F	6.5	0.30		3.1	0.14
	10		NAM	MD11	28.5	11.00		13.4	5.19
		11	NAM	MF	17.5	0.20		8.3	0.09
	11	12	NAM	F	3.8	0.20		1.8	0.09
F5-6	12	13	CDQ	B	6.3	0.15		3.0	0.07
G4-3	13	14	NAM	F	2.1	0.20		1.0	0.09
F4-1	14		NAM	MD11	13.0	12.10		6.1	5.71
		15	NAM	MF	12.1	0.20		5.7	0.09
	15		CMQ	MD10	5.0	3.20		2.4	1.51
		16	CMQ	MF	2.2	0.10		1.0	0.05
F3-3	16	17	NAM	B	160.0	0.60		75.5	0.28
	17	18	NAM	B	4.1	0.20		1.9	0.09
	18		CDQ	MD10	1.8	0.50		0.8	0.24
		19	CDQ	MF	1.8	0.10		0.8	0.05
E4-4	19	20	NAM	F	2.5	0.15		1.2	0.07
E5-4	20		NAM	MD10	5.0	2.10		2.4	0.99
		21	NAM	MF	3.1	0.20		1.5	0.09
	21		CDQ	MD10	5.5	1.60		2.6	0.75
		22	CDQ	MF	2.1	0.10		1.0	0.05
	22	23	NAM	F	12.3	0.20		5.8	0.09
	23		CDQ	MD10	3.6	3.10		1.7	1.46
		24	CDQ	MF	3.6	0.20		1.7	0.09

een Measurement
lated Actual Measurement (On Screen Measurement X 10,000/Magnification)

MVA SCIENTIFIC CONSULTANTS
Air Sample Analysis Sheet

MVA Project# 13129 | Amount Collected(L): 46 | Analyst: MRU
MVA Sample# AE1471 | Grid Opening (mm2): 0.01 | Date: 1/29/2020 - 1/30/2020
Client I.D.: Test D P4 | Filter Area (mm2): 385 | Page: 1 of 1
Instrument: Philips EM120 | Filter Type: MCE | Comments: 016G19
Magnification: 21,200 | Openings Analyzed: 10 | Method: ISO 10312
Acc. Voltage: 100kV | Level of Analysis: CDQ (C) | or ASTM D6281
Level of Analysis: N/A (A)

Grid	Opening	Number of Structures Primary	Number of Structures Total	Class	Structure Type	Length* (cm)	Width* (cm)	Comments	Length** (µm)	Width** (µm)
E7	H3-1	1	1	NAM	B	110.0	0.60		51.9	0.28
		2		NAM	MD11	37.0	5.20		17.5	2.45
			2	NAM	MB	33.5	0.30		15.8	0.14
	G3-3	3	3	NAM	B	103.5	0.50		48.8	0.24
	G4-3	4	4	NAM	B	8.5	0.40		4.0	0.19
		5	5	NAM	B	11.5	0.20		5.4	0.09
	F4-6	6		NAM	MD10	10.3	4.20		4.9	1.98
			6	NAM	MB	7.2	0.40		3.4	0.19
	E5-6	7	7	NAM	B	7.3	0.30		3.4	0.14
		8		CMQ	MD11	15.1	11.00		7.1	5.19
			8	CMQ	MB	14.7	0.25		6.9	0.12
D7	H4-4	9	9	NAM	B	10.8	0.30		5.1	0.14
		10	10	NAM	B	8.4	0.30		4.0	0.14
	G3-3	11		CMQ	MD10	2.6	0.70		1.2	0.33
			11	CMQ	MF	1.8	0.20		0.8	0.09
	F4-6	12		CMQ	MD10	5.2	3.10		2.5	1.46
			12	CMQ	MB	4.1	0.20		1.9	0.09
		13	13	NAM	B	4.4	0.30		2.1	0.14
		14	14	NAM	F	16.0	0.30		7.5	0.14
	E5-4	15	15	NAM	B	31.8	0.70		15.0	0.33
		16	16	NAM	B	12.1	0.40		5.7	0.19
	C4-4	NSD								

*On Screen Measurement
** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

MVA SCIENTIFIC CONSULTANTS
Air Sample Analysis Sheet

MVA Project#	13129	Amount Collected(L):	81	Analyst:	JMS
MVA Sample#	AE1472	Grid Opening (mm2):	0.01	Date:	1/27/2020
Client I.D.:	TD, P5	Filter Area (mm2):	385	Page:	1 of 1
Instrument:	Philips CM120	Filter Type:	MCE	Comments:	
Magnification:	23,100	Openings Analyzed:	10	Method: ISO 10312	x
Acc. Voltage:	100kV	Level of Analysis:	N/A (C)	or ASTM D6281	
		Level of Analysis:	N/A (A)		

Grid	Opening	Number of Structures Primary	Number of Structures Total	Class	Structure Type	Length* (cm)	Width* (cm)	Comments	Length** (µm)	Width** (µm)
E6	H5-4	NSD								
	G5-1	NSD								
	F6-4	NSD								
	E4-4	NSD								
	B4-4	NSD								
D6	H3-1	NSD								
	E2-3	NSD								
	E4-6	NSD								
	F6-4	NSD								
	H6-1	NSD								

*On Screen Measurement
** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1473	G.O. Area (mm2):	0.01	Date:	11/19/2019
Client Sample I.D.:	Field Blank #1	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	N/A	Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	1 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
E7	B3-4	NSD								
	C2-6	NSD								
	C5-6	NSD								
	E5-3	NSD								
	E4-3	NSD								
	E3-3	NSD								
	F2-3	NSD								
	F3-3	NSD								
	F4-3	NSD								
	F5-4	NSD								
	G4-4	NSD								
	G3-6	NSD								
	G3-4	NSD								
	G3-1	NSD								
	G2-3	NSD								
	G2-6	NSD								
	H2-3	NSD								
	H3-1	NSD								
	H4-1	NSD								
	K3-3	NSD								
D7	E3-1	NSD								
	E3-3	NSD								
	E4-1	NSD								
	E4-6	NSD								
	E5-1	NSD								
	E5-6	NSD								
	F6-1	NSD								
	F5-6	NSD								
	F5-1	NSD								
	F4-3	NSD								
	F4-4	NSD								
	F3-6	NSD								
	F3-3	NSD								
	G2-3	NSD								
	G2-6	NSD								
	G3-1	NSD								
	G4-1	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1473	G.O. Area (mm2):	0.01	Date:	11/19/2019
Client Sample I.D.:	Field Blank #1	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:		Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	2 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
D7	G4-6	NSD								
	G5-4	NSD								
	H5-1	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected
**On Screen Measurement
*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)
Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix
SAED: C = Chrysotile, A = Amphibole
EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	N/A	**Analyst:**	MRU
Lab Sample I.D.:	AE1473	**Grid Opening (mm^2):**	0.01	**Date:**	1/21/20
Client Sample I.D.:	Field Blank #1	**Filter Area (mm^2):**	385	**Comments:**	013G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
E7	F3-3	NSD						
	E5-4	NSD						
	E6-6	NSD						
	C6-4	NSD						
	C5-4	NSD						
D7	H5-1	NSD						
	H4-4	NSD						
	G4-4	NSD						
	G5-1	NSD						
	F5-4	NSD						

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1474	G.O. Area (mm2):	0.01	Date:	11/19/2019
Client Sample I.D.:	Field Blank #2	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	N/A	Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	1 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
E6	C3-1	NSD								
	C3-3	NSD								
	C4-3	NSD								
	C5-4	NSD								
	E6-1	NSD								
	E6-4	NSD								
	E5-4	NSD								
	E5-1	NSD								
	E4-3	NSD								
	E4-1	NSD								
	E4-4	NSD								
	E3-3	NSD								
	E3-1	NSD								
	F2-3	NSD								
	F2-6	NSD								
	F3-6	NSD								
	F4-1	NSD								
	F4-6	NSD								
	F5-4	NSD								
	F5-6	NSD								
D6	E6-4	NSD								
	E5-3	NSD								
	E5-4	NSD								
	E4-6	NSD								
	E4-3	NSD								
	E3-3	NSD								
	F3-1	NSD								
	F3-6	NSD								
	F4-1	NSD								
	F4-3	NSD								
	F5-3	NSD								
	F6-1	NSD								
	G6-1	NSD								
	G6-4	NSD								
	G5-3	NSD								
	G5-1	NSD								
	G4-3	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA SCIENTIFIC CONSULTANTS
NIOSH 7402 COUNT SHEET

MVA Project #:	13129	Instrument I.D.:	EM420	Analyst:	MRU
Lab Sample I.D.:	AE1474	G.O. Area (mm2):	0.01	Date:	11/19/2019
Client Sample I.D.:	Field Blank #2	Openings Analyzed:	40	Comments:	
Magnification:	10,500	Volume Collected:	N/A	Grid Box:	013G19
Acc. Voltage:	100kV	Filter Area (mm2):	385	Page	2 of 2

Grid	Opening	Structure Number*	Structure Type	Length** (cm)	Width** (cm)	SAED	EDS	Comments	Length*** (µm)	Width*** (µm)
D6	G4-4	NSD								
	G3-6	NSD								
	G2-6	NSD								

*NFD or NSD = No Fibers Detected or No Structures Detected

**On Screen Measurement

*** Calculated Actual Measurement (On Screen Measurement X 10,000/Magnification)

Structure Type: B = Bundle, C = Cluster, F = Fiber, M = Matrix

SAED: C = Chrysotile, A = Amphibole

EDS: C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

MVA Scientific Consultants
AHERA Count Sheet

MVA Project #:	13129	**Amount Collected(l):**	N/A	**Analyst:**	MRU
Lab Sample I.D.:	AE1474	**Grid Opening (mm^2):**	0.01	**Date:**	1/21/20
Client Sample I.D.:	Field Blank #2	**Filter Area (mm^2):**	385	**Comments:**	013G19
Instrument I.D.:	EM420	**Filter Type:**	MCE	**Page:**	1 of 1
Magnification:	20,800	**Openings Analyzed:**	10		
Acc. Voltage:	100kV				

		Structure	Structure	Length (µm)				
Grid	**Opening**	**Number**	**Type[α]**	**0.5 - 4.9**	**≥ 5.0**	**SAED[β]**	**EDS[ς]**	**Comments**
E6	H5-6	NSD						
	H4-4	NSD						
	G4-6	NSD						
	G5-3	NSD						
	F5-4	NSD						
D6	F5-6	NSD						
	F4-4	NSD						
	G4-4	NSD						
	G5-1	NSD						
	F5-4	NSD						

[α] B = Bundle
C = Cluster
F = Fiber
M = Matrix

NFD or NSD = No Fibers Detected or No Structures Detected
N = No Diffraction Obtained

[β] C = Chrysotile, A = Amphibole

[ς] C = Chrysotile, AM = Amosite, CR = Crocidolite, AC = Actinolite, AN = Anthophyllite, TR = Tremolite, N = Non Asbestos

Chain of Custody, Remington Exposure Simulation (12 gauge)

	Shell Description	**Remington Box ID**	**CC Box #**
	Green 12 gauge 2 3/4 inch shell 1 1/8 oz #6 shot 3 1/4 oz dram equivalent	BP/LCL08H516	1
	Green 12 gauge 2 3/4 inch shell 1 1/8 oz #6 shot 3 1/4 oz dram equivalent	BP/LCL08H516	1
	Green 12 gauge 2 3/4 inch shell 1 1/8 oz #6 shot 3 1/4 oz dram equivalent	BP/LCL08H516	1
	Green 12 gauge 2 3/4 inch shell 1 1/8 oz #6 shot 3 1/4 oz dram equivalent	BP/LCL08H516	1
CC Box #1	Green 12 gauge 2 3/4 inch shell 1 1/8 oz #6 shot 3 1/4 oz dram equivalent	BP/LCL08H516	1
AE1386	Green 12 gauge 2 3/4 inch shell 1 1/8 oz #6 shot 3 1/4 oz dram equivalent	BP/LCL08H516	1
	Green 12 gauge 2 3/4 inch shell 1 1/8 oz #6 shot 3 1/4 oz dram equivalent	BP/LCL08H516	1
	Green 12 gauge 2 3/4 inch shell 1 1/8 oz #6 shot 3 1/4 oz dram equivalent	BP/LCL08H516	1
	Green 12 gauge 2 3/4 inch shell 1 1/8 oz #6 shot 3 1/4 oz dram equivalent	BP/LCL08H516	1
	Green 12 gauge 2 3/4 inch shell 1 1/8 oz #6 shot 3 1/4 oz dram equivalent	BP/LCL08H516	1
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
CC Box #2	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
AE1387	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #8 shot 3 oz dram equivalent	BP/BF26C5	2
	Red 12 gauge 2 3/4 inch shell 1 oz #6 shot 3 oz dram equivalent	BP/AG08A7DP	3
	Red 12 gauge 2 3/4 inch shell 1 oz #6 shot 3 oz dram equivalent	BP/AG08A7DP	3
	Red 12 gauge 2 3/4 inch shell 1 oz #6 shot 3 oz dram equivalent	BP/AG08A7DP	3
	Red 12 gauge 2 3/4 inch shell 1 oz #6 shot 3 oz dram equivalent	BP/AG08A7DP	3
CC Box #3	Red 12 gauge 2 3/4 inch shell 1 oz #6 shot 3 oz dram equivalent	BP/AG08A7DP	3
AE1388	Red 12 gauge 2 3/4 inch shell 1 oz #6 shot 3 oz dram equivalent	BP/AG08A7DP	3
	Red 12 gauge 2 3/4 inch shell 1 oz #6 shot 3 oz dram equivalent	BP/AG08A7DP	3
	Red 12 gauge 2 3/4 inch shell 1 oz #6 shot 3 oz dram equivalent	BP/AG08A7DP	3
	Red 12 gauge 2 3/4 inch shell 1 oz #6 shot 3 oz dram equivalent	BP/AG08A7DP	3

Chain of Custody, Remington Exposure Simulation (12 gauge)

	Red 12 gauge 2 3/4 inch shell 1 oz #6 shot 3 oz dram equivalent	BP/AG08A7DP	3
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
CC Box#6	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
AE1389	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 3 inch shell 1 7/8 oz #2 shot 4 1/2 oz dram equivalent	BP/AT11P24	6
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
CC Box#7	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
AE1390	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7

Chain of Custody, Remington Exposure Simulation (12 gauge)

	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/BF22K6R	7
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/AM21E4	8
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/AM21E4	8
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/AM21E4	8
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/AM21E4	8
CC Box#8	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/AM21E4	8
AE1391	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/AM21E4	8
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/AM21E4	8
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/AM21E4	8
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/AM21E4	8
	Green 12 gauge 2 3/4 inch shell 1 1/4 oz #7.5 shot 3 3/4 oz dram equivalent	BP/AM21E4	8
	Green 12 gauge 2 3/4 inch shell 1 1/2 oz #2 shot	BP/AF18H2R	10
	Green 12 gauge 2 3/4 inch shell 1 1/2 oz #2 shot	BP/AF18H2R	10
CC Box#10	Green 12 gauge 2 3/4 inch shell 1 1/2 oz #2 shot	BP/AF18H2R	10
AE1392	Green 12 gauge 2 3/4 inch shell 1 1/2 oz #2 shot	BP/AF18H2R	10
	Green 12 gauge 2 3/4 inch shell 1 1/2 oz #2 shot	BP/AF18H2R	10

Total Shells 105

Recieved by:

Relinquished by (sign): [signature]	~~Relinquished by (sign):~~ [signature]
Via: UPS Ground	Via: UPS
Date: 10/15/19 Printed Name: Devitt Cooney	Date: 10/17/19 Printed Name: STEVEN COMPTON
Company: Cooney & Conway	Company: MVA SCIENTIFIC CONSULTANTS

Relinquished by (sign):	Relinquished by (sign):
Via:	Via:
Date: Printed Name:	Date: Printed Name:
Company:	Company: