Fire Research Laboratory
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Test record

ASCLD/LAB–*International* Testing Accreditation Certificate ALI-217-T

Title	Evaluation of Ignitability of Carpet Using Methenamine Tablets		
Test Type	Custom		
Lab Number	16F0075-3	**Author**	
Test dates	6/8/17	**No. Tests**	5

Introduction

Five (5) experiments were conducted to investigate the ignitability of carpet using a methenamine pill as the ignition source. One (1) methenamine pill, used as an even and timed burning source, was placed in the center of each carpet sample during testing. Photographs and videos were recorded during the experiments. The experiments were conducted in the Medium Burn Room (MBR) of the Bureau of Alcohol, Tobacco, Firearms and Explosive (ATF) Fire Research Laboratory (FRL) located in Beltsville, MD.

Table of Contents

NOTE : All dimensional measurements were taken in English units and were later converted to metric units. Any inconsistencies between the two units are due to rounding errors when the English units were converted to metric.

Experiment Setup

Experiments were conducted under the 1 Megawatt (MW) Fire Product Collector (FPC) in the MBR, as shown in Figure 1. Each experiment included the carpet samples positioned on a sheet of gypsum wallboard.

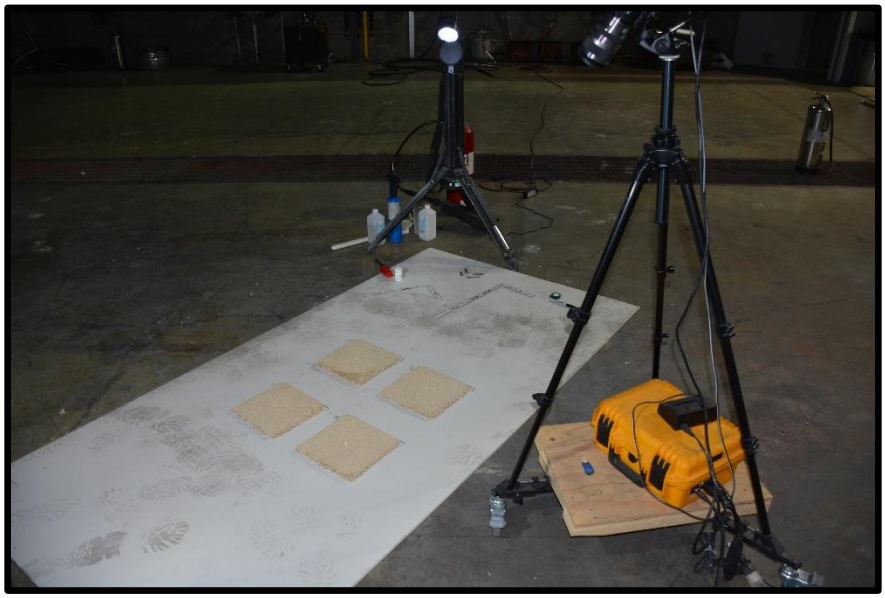

Figure 1. Experimental setup (193874_792750.jpg)

Carpet

Five (5) carpet samples were used during testing. As seen in

Table 1, carpet pile heights ranged between 0.9 cm (0.34 in) to 2 cm (0.78 in). Carpet samples A, B, D and E were cut into 23 cm (9 inches) squares.

Additionally, Sample F was used during the test series. Manufacturer information on Sample F was unknown. Sample F was approximately 10cm x 16cm (4in x 6in) in size. The pile height of Sample F was approximately between 1.3cm (0.5 in) and 1.6cm (0.63 in). Images of all carpet samples are shown in

Table 2.

All carpet samples were conditioned in the MBR for at least five (5) days prior to testing. The temperature in the room during that period averaged 24 degrees Celsius (75 degrees Fahrenheit). The humidity during that period averaged 53%. Since this is not an actively conditioned space, the minimum humidity during the period was 40% and the maximum humidity during the period was 69%.

Table 1. Carpet Samples

Sample Label	Carpet Brand	Description	Style	Pile Height cm/(inch)	Model Number
A	Lifeproof	Tyus II	texture	2.0/(0.78)	H5042-4205-1200-AB
B	Platinum Plus	Harvest II	texture	1.4/(0.56)	H5058-5935-1200
D	Softspring	Tremendous II	texture	1.3/(0.5)	HDC8181702
E	Lifeproof	Fashion Feature	pattern	0.9/(0.34)	H5050-5006-1200-AB
F	Unknown	Unknown	Unknown	1.3-1.6/(0.5-0.63)	Unknown

Table 2. Carpet Sample Images

Sample ID	Image
A	 **(203912_804055.jpg)**
B	 **(203913_804089.jpg)**
D	 **(203914_804112.jpg)**
E	 **(203915_804136.jpg)**
F	 **(203916_804162.jpg)**

Methenamine

Methenamine tablets, chemical name of Hexamethylenetetramine, were used to provide a source of fuel for ignitability testing of the carpet samples. As shown in Figure 2 the tablets used were manufactured by Vesta (Lot No. 5050/ UPC 36154-12800). Methenamine tablets are white in color and approximately 6.1 mm (0.24 in) in diameter. An image of a tablet used for testing in shown in Figure 3.

Figure 2. Methenamine (203912_804048.jpg)

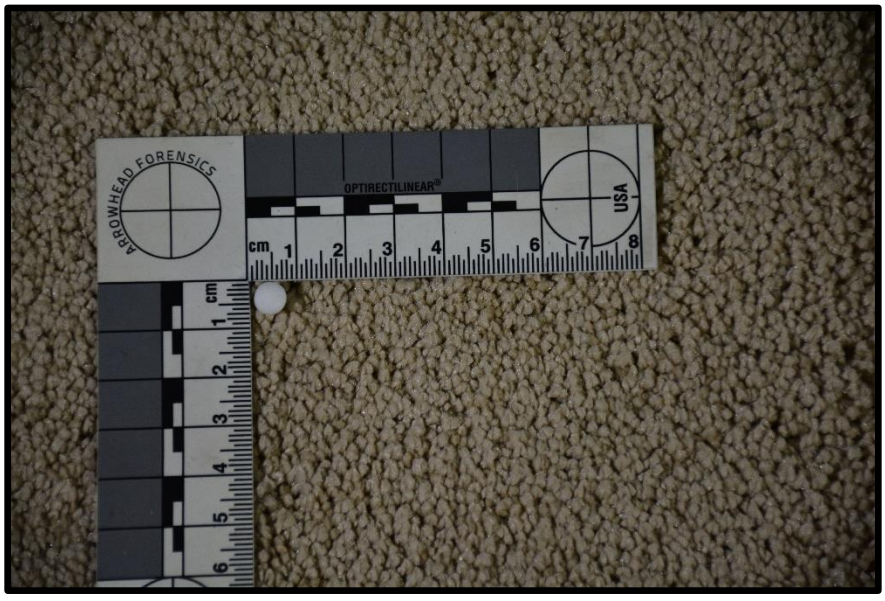

Figure 3. Methenamine tablet (203912_804058.jpg)

Ignition

As seen in Figure 4 a butane lighter was used to ignite the methenamine pills on the surface of each carpet sample.

Figure 4. Ignition of methenamine pill (203912_804059.jpg)

Experiment Details

Test Matrix

Table 3 summarizes the five (5) experiments conducted in the test series.

Table 3. Summary of tests conducted

Test No.	Experiment ID	Carpet Samples
1	203912	A-11/A-12/A-13/A-14
2	203913	B-11/B-12/B-13/B-14
3	203914	D-11/D-12/D-13/D-14
4	203915	E-11/E-12/E-13/E-14
5	203916	F-1

Test Procedure

During each test, the carpet samples were placed on a 4 ft x 8 ft sheet of gypsum wallboard.

For samples A, B, D and E, four (4) samples of the same sample type were placed in a grid, as seen in Figure 5. A methenamine tablet was placed in the center of each sample. Each test was started with the ignition of the first methenamine tablet. The remaining methenamine tablets were ignited and an event was recorded with each ignition. Tests were terminated after all flames self-extinguished.

Figure 5. Sample grid (203912_804054.jpg)

In Experiment 203916, two methenamine tablets were placed along the centerline of the width of Sample F, as shown in Figure 6. The experiment was started with the ignition of the first methenamine tablet. An event was recorded for the ignition of the second tablet. The experiment was terminated after flames self-extinguished.

Figure 6. Sample F (203916_804161.jpg)

Instrumentation

The experiments were documented using digital photography and videos.

Laboratory Conditions

The ambient laboratory temperature, barometric pressure, and relative humidity were measured during the experiment(s). The laboratory conditions were measured using an industrial probe and microserver. The probe measures the ambient conditions using capacitive digital sensors. The sensor probe has surface mounted circuitry which responds to changes in the environment and outputs a digital signal. The Laboratory Conditions were measured in accordance with the method defined in FRL Laboratory Instruction "LI017 Laboratory Conditions" [1].

The following table provides a description of the instrumentation used to collect the ambient laboratory conditions measurements during the experiments.

Table 4. Lab Conditions Description

Experiment ID	Description	Manufacturer	Model
203912	MBR_01	OMEGA	IBTHP-5
203913	MBR_01	OMEGA	IBTHP-5
203914	MBR_01	OMEGA	IBTHP-5
203915	MBR_01	OMEGA	IBTHP-5
203916	MBR_01	OMEGA	IBTHP-5

The following table provides a summary of the initial conditions at the start of the experiment(s).

Table 5. Ambient Laboratory Condition Summary

Experiment ID	Description	Initial (C)	Initial (kPa)	Initial (%)
203912	MBR_01	24	101	36
203913	MBR_01	24	101	38
203914	MBR_01	24	101	38
203915	MBR_01	24	101	37
203916	MBR_01	24	101	36

Experiment Photographs

Digital Cameras are used within the FRL to record digital still photographs during experiments. Digital Cameras used during this test series were used in accordance with the method defined in FRL Laboratory Instruction "LI003 Digital Cameras" [2].

Results for Test 1 (ID 203912)

The following table provides a description of the video(s) taken during this experiment.

Table 6. Video Log

Description	Start Time	Video Duration (s)	Filename
HD CAMERA	02:18:15	146	203912_20170608_141815_15.mov
MASTER			203912_960298.mov

The following figures show all of the still photographs uploaded into the FireTOSS system. The caption below each figure provides the picture's filename as well as any description and elapsed test time associated with the picture.

Figure 7. Pre test 5 minutes (203912_804048)

Figure 8. Pre test 5 minutes (203912_804049)

Figure 9. Pre test 5 minutes (203912_804050)

Figure 10. Pre test 4 minutes (203912_804051)

Figure 11. Pre test 2 minutes (203912_804052)

Figure 12. Pre test 118 seconds (203912_804053)

Figure 13. Pre test 112 seconds (203912_804054)

Figure 14. Pre test 106 seconds (203912_804055)

Figure 15. Pre test 96 seconds (203912_804056)

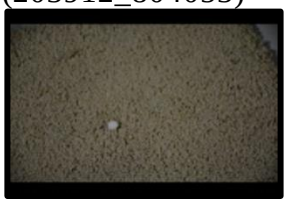

Figure 16. Pre test 90 seconds (203912_804057)

Figure 17. Pre test 66 seconds (203912_804058)

Figure 18. 4 seconds (203912_804059)

Figure 19. 6 seconds (203912_804060)

Figure 20. 12 seconds (203912_804061)

Figure 21. 14 seconds (203912_804062)

Figure 22. 18 seconds (203912_804063)

Figure 23. 22 seconds (203912_804064)

Figure 24. 30 seconds (203912_804065)

Figure 25. 48 seconds (203912_804066)

Figure 26. 82 seconds (203912_804067)

Figure 27. Post test 0 minutes (203912_804068)

Figure 28. Post test 0 minutes (203912_804069)

Figure 29. Post test 0 minutes (203912_804070)

Figure 30. Post test 0 minutes (203912_804071)

Figure 31. Post test 0 minutes (203912_804072)

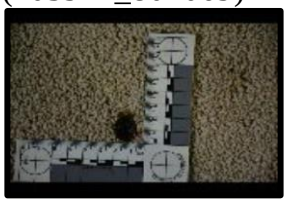

Figure 32. Post test 0 minutes (203912_804073)

Figure 33. Post test 1 minutes (203912_804074)

Figure 34. Post test 1 minutes (203912_804075)

Figure 35. Post test 1 minutes (203912_804076)

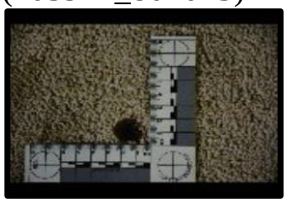

Figure 36. Post test 1 minutes (203912_804077)

Figure 37. Post test 1 minutes (203912_804078)

Figure 38. Post test 1 minutes (203912_804079)

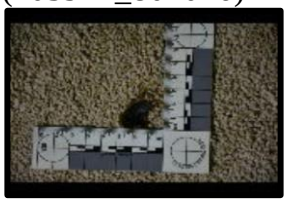

Figure 39. Post test 1 minutes (203912_804080)

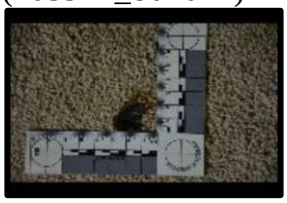

Figure 40. Post test 1 minutes (203912_804081)

Results for Test 2 (ID 203913)

The following table provides a description of the video(s) taken during this experiment.

Table 7. Video Log

Description	Start Time	Video Duration (s)	Filename
HD CAMERA	02:29:31	152	203913_20170608_142931_15.mov
MASTER			203913_960299.mov

The following figures show all of the still photographs uploaded into the FireTOSS system. The caption below each figure provides the picture's filename as well as any description and elapsed test time associated with the picture.

Figure 41. Pre test 4 minutes (203913_804085)

Figure 42. Pre test 2 minutes (203913_804086)

Figure 43. Pre test 2 minutes (203913_804087)

Figure 44. Pre test 2 minutes (203913_804088)

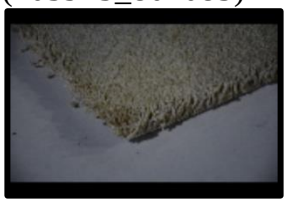

Figure 45. Pre test 2 minutes (203913_804089)

Figure 46. Pre test 12 seconds (203913_804090)

Figure 47. 6 seconds (203913_804091)

Figure 48. 12 seconds (203913_804092)

Figure 49. 20 seconds (203913_804093)

Figure 50. 26 seconds (203913_804094)

Figure 51. 32 seconds (203913_804095)

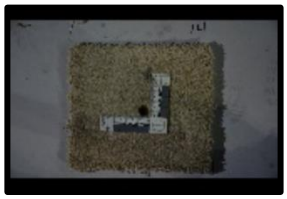

Figure 52. Post test 0 minutes (203913_804096)

Figure 53. Post test 0 minutes (203913_804097)

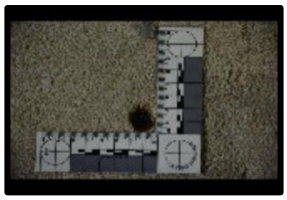

Figure 54. Post test 0 minutes (203913_804098)

Figure 55. Post test 0 minutes (203913_804099)

Figure 56. Post test 0 minutes (203913_804100)

Figure 57. Post test 1 minutes (203913_804101)

Figure 58. Post test 1 minutes (203913_804102)

Figure 59. Post test 1 minutes (203913_804103)

Figure 60. Post test 1 minutes (203913_804104)

Results for Test 3 (ID 203914)

The following table provides a description of the video(s) taken during this experiment.

Table 8. Video Log

Description	Start Time	Video Duration (s)	Filename
HD CAMERA	02:39:03	147	203914_20170608_143903_15.mov
MASTER			203914_960300.mov

The following figures show all of the still photographs uploaded into the FireTOSS system. The caption below each figure provides the picture's filename as well as any description and elapsed test time associated with the picture.

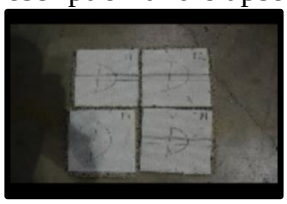

Figure 61. Pre test 117 seconds (203914_804108)

Figure 62. Pre test 32 seconds (203914_804109)

Figure 63. Pre test 26 seconds (203914_804110)

Figure 64. Pre test 24 seconds (203914_804111)

Figure 65. Pre test 20 seconds (203914_804112)

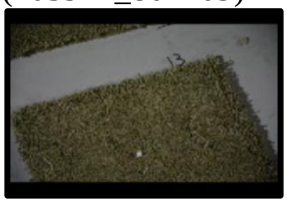

Figure 66. Pre test 10 seconds (203914_804113)

Figure 67. 12 seconds (203914_804114)

Figure 68. 16 seconds (203914_804115)

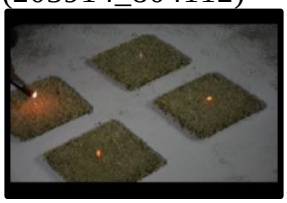

Figure 69. 26 seconds (203914_804116)

Figure 70. 30 seconds (203914_804117)

Figure 71. 96 seconds (203914_804118)

Figure 72. Post test 0 minutes (203914_804119)

Figure 73. Post test 0 minutes (203914_804120)

Figure 74. Post test 0 minutes (203914_804121)

Figure 75. Post test 0 minutes (203914_804122)

Figure 76. Post test 0 minutes (203914_804123)

Figure 77. Post test 0 minutes (203914_804124)

Figure 78. Post test 1 minutes (203914_804125)

Figure 79. Post test 1 minutes (203914_804126)

Figure 80. Post test 1 minutes (203914_804127)

Results for Test 4 (ID 203915)

The following table provides a description of the video(s) taken during this experiment.

Table 9. Video Log

Description	Start Time	Video Duration (s)	Filename
HD CAMERA	02:46:30	141	203915_20170608_144630_15.mov
MASTER			203915_960301.mov

The following figures show all of the still photographs uploaded into the FireTOSS system. The caption below each figure provides the picture's filename as well as any description and elapsed test time associated with the picture.

Figure 81. Pre test 104 seconds (203915_804131)

Figure 82. Pre test 24 seconds (203915_804132)

Figure 83. Pre test 18 seconds (203915_804133)

Figure 84. Pre test 16 seconds (203915_804134)

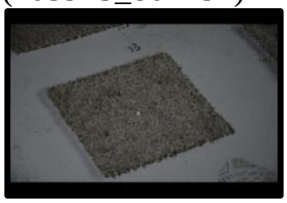

Figure 85. Pre test 12 seconds (203915_804135)

Figure 86. Pre test 8 seconds (203915_804136)

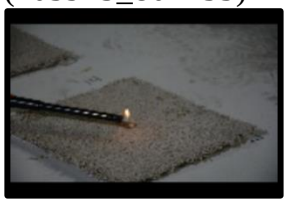

Figure 87. 8 seconds (203915_804137)

Figure 88. 14 seconds (203915_804138)

Figure 89. 20 seconds (203915_804139)

Figure 90. 24 seconds (203915_804140)

Figure 91. 34 seconds (203915_804141)

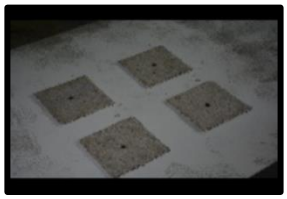

Figure 92. Post test 0 minutes (203915_804142)

Figure 93. Post test 0 minutes (203915_804143)

Figure 94. Post test 0 minutes (203915_804144)

Figure 95. Post test 0 minutes (203915_804145)

Figure 96. Post test 0 minutes (203915_804146)

Figure 97. Post test 0 minutes (203915_804147)

Figure 98. Post test 0 minutes (203915_804148)

Figure 99. Post test 1 minutes (203915_804149)

Figure 100. Post test 1 minutes (203915_804150)

Figure 101. Post test 1 minutes (203915_804151)

Figure 102. Post test 1 minutes (203915_804152)

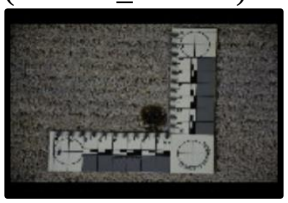

Figure 103. Post test 1 minutes (203915_804153)

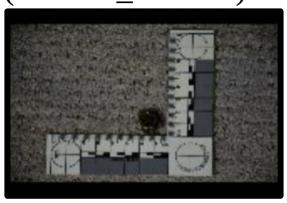

Figure 104. Post test 1 minutes (203915_804154)

Results for Test 5 (ID 203916)

The following table provides a description of the video(s) taken during this experiment.

Table 10. Video Log

Description	Start Time	Video Duration (s)	Filename
HD CAMERA	02:56:41	162	203916_20170608_145641_15.mov
MASTER			203916_960302.mov

The following figures show all of the still photographs uploaded into the FireTOSS system. The caption below each figure provides the picture's filename as well as any description and elapsed test time associated with the picture.

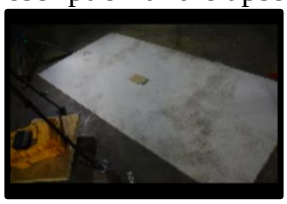

Figure 105. Pre test 48 seconds (203916_804158)

Figure 106. Pre test 46 seconds (203916_804159)

Figure 107. Pre test 38 seconds (203916_804160)

Figure 108. Pre test 36 seconds (203916_804161)

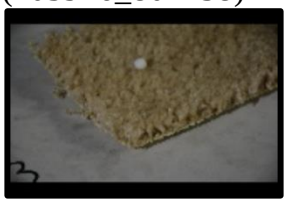

Figure 109. Pre test 30 seconds (203916_804162)

Figure 110. Pre test 26 seconds (203916_804163)

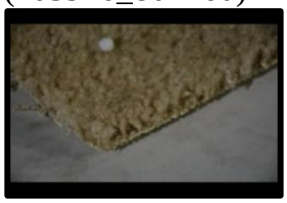

Figure 111. Pre test 16 seconds (203916_804164)

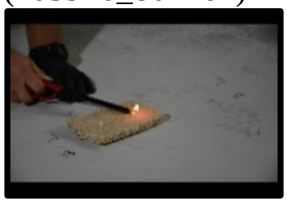

Figure 112. 4 seconds (203916_804165)

Figure 113. 6 seconds (203916_804166)

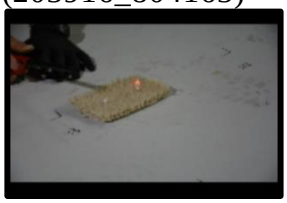

Figure 114. 8 seconds (203916_804167)

Figure 115. 12 seconds (203916_804168)

Figure 116. 14 seconds (203916_804169)

Figure 117. 22 seconds (203916_804170)

Figure 118. 28 seconds (203916_804171)

Figure 119. 28 seconds (203916_804172)

Figure 120. 36 seconds (203916_804173)

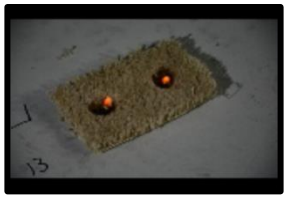

Figure 121. 80 seconds (203916_804174)

Figure 122. 108 seconds (203916_804175)

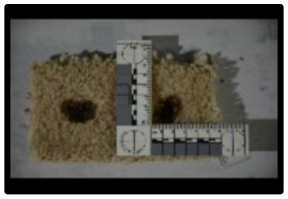

Figure 123. Post test 0 minutes (203916_804176)

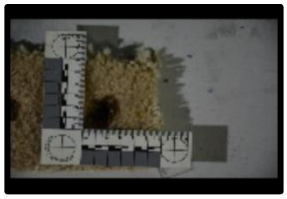

Figure 124. Post test 0 minutes (203916_804177)

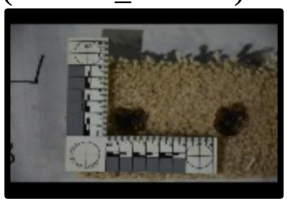

Figure 125. Post test 1 minutes (203916_804178)

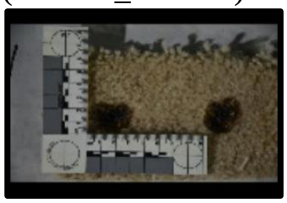

Figure 126. Post test 1 minutes (203916_804179)

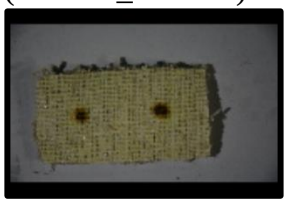

Figure 127. Post test 1 minutes (203916_804180)

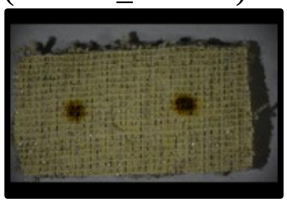

Figure 128. Post test 1 minutes (203916_804181)

References

1. Laboratory Instruction LI017 – Laboratory Conditions, Bureau of Alcohol, Tobacco, Firearms and Explosives - Fire Research Laboratory, Beltsville, MD.

2. Laboratory Instruction LI003 - Digital Cameras, Bureau of Alcohol, Tobacco, Firearms and Explosives - Fire Research Laboratory, Beltsville, MD