



## **GSR Distance Determination Test No. 21-5301/5 Summary Report**

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Each sample set contained one of the following: An evidence piece of clothing for chemical processing for a GSR pattern (Q1) and either photographs (21-5301) or directly downloadable digital images (21-5305) of GSR patterns produced by test shots at known distances. These were provided on untreated test fabric (K1a) and treated test fabric after chemical processing using Modified Griess (K1b) and Sodium Rhodizonate (K1c). Participants were requested to process the Q1 clothing sample and report the range of distances, along with their conclusions and comments. Data were returned from 111 participants and are compiled into the following tables:

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This report contains the data received from the participants in this test. Since these participants are located in many countries around the world, and it is their option how the samples are to be used (e.g., training exercise, known or blind proficiency testing, research and development of new techniques, etc.), the results compiled in the Summary Report are not intended to be an overview of the quality of work performed in the profession and cannot be interpreted as such. The Summary Comments are included for the benefit of participants to assist with maintaining or enhancing the quality of their results. These comments are not intended to reflect the general state of the art within the profession.

Participant results are reported using a randomly assigned "WebCode". This code maintains participant's anonymity, provides linking of the various report sections, and will change with every report.

## **Manufacturer's Information**

Each sample set contained a piece of clothing evidence (Q1) for chemical processing and either photographs or digital images of known distance test GSR patterns on unprocessed test fabric (K1a) and test fabric after chemical processing using Modified Griess (K1b) and Sodium Rhodizonate (K1c). Participants were requested to process the clothing item and report the range of distances that the muzzle of the firearm could have been from the fabric (Q1) at the time of discharge.

**SAMPLE PREPARATION:** The firearm used to produce the distance standards and evidence item was a Glock 17 9mm semiautomatic handgun with a 5" Bear Creek Arsenal aftermarket barrel and the ammunition used was Winchester 9mm 147 grain FMJ.

**DISTANCE STANDARDS (K1a-c):** The fabric used for the known distances was white cotton. The firearm was locked into a fixture and the white cotton fabric was placed at a predetermined distance from the firearm. This was done for each of the predetermined distances. First, the known GSR patterns were imaged. Each known pattern was then processed using the Modified Griess procedure. Immediately following processing, the film paper was imaged. Finally, the known patterns were processed with Sodium Rhodizonate reagents, and the fabric imaged immediately after processing.

**QUESTIONED ITEM (Q1):** Item Q1 consisted of one section of a white T-shirt material (60% Cotton, 40% Polyester blend knit). The firearm was locked into a fixture and the shirt was placed 11 inches away from the muzzle of the firearm. After firing, the article of clothing (Q1) was packaged between two pieces of chipboard and placed into an envelope. This process was repeated until all of the items were created.

**SAMPLE SET ASSEMBLY:** For the printed photos, the Q1, K1a, K1b, and K1c envelopes were placed into a pre-labeled sample pack envelope, sealed with evidence tape, and initialed "CTS." For the Digital Download version, the Q1 item was placed in a pre-labeled sample pack envelope and the K1a, K1b and K1c files were loaded onto the CTS Portal.

**VERIFICATION:** All three predistribution laboratories reported a "greater than" distance of 6 inches and a "less than" distance of 18 inches.

## **Summary Comments**

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This test was designed to allow participants to assess their proficiency in muzzle to target distance determination using gunshot residue (GSR) patterns. Each participant received an evidence piece of clothing for chemical processing (Q1), images of GSR patterns at known distances on untreated fabric (K1a), and images of GSR patterns at known distances on fabric chemically processed using Modified Griess (K1b) and Sodium Rhodizonate (K1c). The evidence piece of clothing (Q1) was prepared with the firearm locked into a fixture and the white T-shirt material (60% Cotton, 40% Polyester blend knit) placed 11 inches away from the muzzle of the firearm (refer to the Manufacturer's Information for preparation details).

For greater than/less than distances, a +/-2 inch allowance from the known shot distance (11 inches) was used as the baseline. This resulted in an acceptable "greater than" distance response of 0 to 13 inches and an acceptable "less than" distance response of 9 to 27 inches. In Table 1 (Distance Determination Results), 99 of the 111 responding participants (89%) reported a "greater than" distance between 3 and 12 inches and 103 participants (93%) reported a "less than" distance between 12 and 24 inches. Eight participants did not report a "greater than/less than" range, but did provide distance related results in their conclusions. In the summary of this table, CTS has grouped the responses provided by the participants based on their "greater than"/"less than" distance results and provided a tally of the ranges between responses as calculated by CTS.

CTS then reviewed the ranges based on participants' reported values and determined the most common reported range, the mode, was 12 inches. A 3-inch allowance was applied to the modal value to account for the difference between the known standard distances. Therefore, any reported range larger than 15 inches was highlighted as inconsistent. In Table 1, two participants reported a range outside this accepted range.

CTS is aware that laboratory reporting policies differ and there are varying acceptable ranges. It will therefore be at the discretion of the laboratory to further evaluate participant's results based on their own policies and procedures.

# Distance Determination Results

What is the distance range that the muzzle of the firearm could have been from the shirt (Q1) at the time of discharge? Please report a numeral response (e.g. 6) from the supplied Distance Standards. If reporting Contact, indicate with the numeral 0.

TABLE 1  
(Distance in Inches)

WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range
223QK2- 5305	9	15	6	6G32HV- 5301	6	15	9	9RQCRT- 5305	15	21	6
3CXJ7X- 5301	6	15	9	6TGYMY- 5301	6	18	12	A2V7YQ- 5305	6	15	9
3ELV74- 5301	9	21	12	6V6BL6- 5301	12	21	9	A69EDV- 5301	9	21	12
3GPQP7- 5301				6XCQVW- 5301	9	18	9	ATZCFT- 5301			
3V7L63- 5301	6	18	12	6ZD4QV- 5301	9	12	3	B3K3EP- 5301	3	15	12
3VC8R7- 5301	6	21	15	7BATK3- 5301	12	21	9	BALNDZ- 5305	9	18	9
3WKK98- 5305	9	18	9	7TUKJ2- 5305	3	15	12	BPBJGV- 5301	6	18	12
437ZC6- 5305	3	15	12	7VEYZ2- 5301	12	21	9	BPYMBQ- 5301	3	18	15
484LG8- 5305	3	18	15	8796GZ- 5301	9	21	12	BV3UQT- 5301	6	15	9
4G9WNW- 5305	6	18	12	8B4YD2- 5301	15	18	3	BXTR6R- 5301	6	15	9
4JW9M3- 5301	9	18	9	8BBDZV- 5301	6	18	12	C7ZU4X- 5301	6	15	9
4THA7X- 5301	6	18	12	8FJ722- 5301	9	21	12	CMM8GP- 5301	12	24	12
68XU3V- 5301	6	24	18	8NVT4U- 5301	6	18	12	D3VDRU- 5301	3	18	15
6CRNZW- 5301				9448XX- 5301	6	18	12	ERBT2M- 5305	12	24	12

TABLE 1  
(Distance in Inches)

WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range
EVC8VM- 5305	6	18	12	JGX3PM- 5305	6	21	15	MMP9HL- 5301	9	18	9
EW63HV- 5305	6	18	12	JNEX6G- 5301	9	18	9	NBUPUK- 5305	0	15	15
F9PPUL- 5301	15	21	6	JXLDBP- 5301	9	18	9	NC6PQE- 5305	15	24	9
FJX6ZU- 5301				KLMZQJ- 5305	9	15	6	NHT8UC- 5301	3	15	12
FK4MYP- 5301	9	21	12	KMFK6P- 5305	12	21	9	P3VCWC- 5305	12	24	12
G3HHRN- 5301	9	21	12	KMZ4CG- 5301	6	15	9	PEQTYC- 5301	9	24	15
H4TKDM- 5305	12	18	6	KW6GJP- 5301				PGCA2C- 5301	9	15	6
H7GWDT- 5301	6	21	15	L6ABQM- 5301				PJX2H- 5305	9	18	9
HA2F8H- 5301	9	15	6	LNPKRN- 5301	6	21	15	PKBLXC- 5305	9	15	6
HM6AQK- 5301	9	24	15	LPX2YE- 5301	12	21	9	PQ6Q4F- 5305	9	15	6
HQM4ER- 5301	12	24	12	LV44BM- 5301	6	18	12	PVF4LE- 5305	12	15	3
HX7URR- 5305	9	21	12	M3KYRH- 5301	6	15	9	QCJXTE- 5305	6	15	9
J92Z8Q- 5301	12	21	9	MDK24L- 5301	6	18	12	QL62ZE- 5301	9	18	9
JEAQPG- 5301	6	24	18	MG2WWH - 5301	6	18	12	R83P6E- 5301	6	21	15
JGU8RG- 5301	0	12	12	MK29TH- 5305	6	18	12	RCF3W9- 5301	9	21	12

**TABLE 1**  
(Distance in Inches)

WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range	WebCode- Test	Greater Than	Less Than	Calc. Range
RPF49A- 5301	8	20	12	XCX674- 5301	9	18	9				
RUTAXA- 5301	12	24	12	Y9UTMA- 5305	3	15	12				
RVL7KH- 5301	6	21	15	YBUPY3- 5301							
TK3BKA- 5305	9	15	6	YDMKLB- 5301	6	18	12				
TL EE69- 5305	9	15	6	YMP9M3- 5301	12	24	12				
TUPGQ9- 5305	6	15	9	YV2XD2- 5301	12	24	12				
TYZU98- 5301	6	18	12	Z26TJ2- 5301	9	21	12				
VGCN37- 5301	6	18	12	Z6KZ82- 5305	6	15	9				
W9YY3C- 5301	6	18	12	ZXAAV3- 5301	12	18	6				
WJDNP4- 5301	6	15	9								
WMFUH9- 5305	9	15	6								
WPLCF6- 5301	6	15	9								
WRANFA- 5301	6	18	12								
X2UFE8- 5305	9	15	6								
X6TTZC- 5301											

<b>Distance Determination</b>					
<b>Response Summary</b>				<b>Participants: 111</b>	
<b>Greater Than Distance</b>	<b>Participants Reporting</b>	<b>Less Than Distance</b>	<b>Participants Reporting</b>	<b>CTS Calculated Range</b>	<b>Participants Reporting</b>
Contact / 0	2 (1.80%)	Contact / 0	0 (0.00%)	3	3 (2.70%)
3	8 (7.21%)	3	0 (0.00%)	6	14 (12.61%)
6	40 (36.04%)	6	0 (0.00%)	9	30 (27.03%)
9	32 (28.83%)	9	0 (0.00%)	12	42 (37.84%)
12	16 (14.41%)	12	2 (1.80%)	15	12 (10.81%)
15	4 (3.60%)	15	30 (27.03%)	18	2 (1.80%)
18	0 (0.00%)	18	35 (31.53%)	21	0 (0.00%)
21	0 (0.00%)	21	23 (20.72%)	24	0 (0.00%)
24	0 (0.00%)	24	12 (10.81%)	Other	0 (0.00%)
27	0 (0.00%)	27	0 (0.00%)	No Response	8 (7.21%)
Other	1 (0.90%)	Other	1 (0.90%)		
No Response	8 (7.21%)	No Response	8 (7.21%)		

# Conclusions

TABLE 2

WebCode- Test	Conclusions
223QK2- 5305	The shirt presents a bullet hole inflicted by short distance in a range between 9 and 15 inches.
3CXJ7X- 5301	The residue pattern from item 1.1 indicates a muzzle-to-target distance between 6 – 15 inches.
3ELV74- 5301	A hole was present in the approximate center of the Q1 shirt. The hole and the area around the hole was visually, microscopically, and chemically processed for the presence of firearm discharge residues. The gunshot residue pattern around the hole is consistent with tests fired at a muzzle -to-target distance greater than 9 inches and less than 21 inches.
3GPPQ7- 5301	1. Exhibit 2 is a piece of white fabric with a defect near the center. Examination of Exhibit 2 revealed that the defect is consistent with the discharge of a firearm at a close range of fire.
3V7L63- 5301	<p>Clothing Analysis: Methodology: Physical (Visual Examination); Chemical (Color Test Modified Griess/Sodium Rhodizonate); Microscopy (Stereo Microscope). The defect/hole, designated as "A", measured approximately 1/4 inch in greatest dimensions and was located approximately 4 1/2 inches below the top edge and 4 inches from the right edge of the piece of cloth twill jean. Visual and microscopic examination of defect/hole "A" revealed the presence of apparent bullet wipe/soot/gunpowder. The patterns of apparent soot measured approximately 4 inches in diameter. The patterns of apparent gunpowder measured approximately 2 1/2 inches in diameter. Chemical testing of defect/hole "A" indicates the presence of *nitrite residues/**lead residues. Note: *Nitrites are present in gunpowder residue. **Lead residue can be present in bullets/bullet cores and ammunition primers. Opinion/Interpretation: Examination of defect/hole "A" indicated that it was visually consistent with the passage of a projectile/bullet based upon the physical characteristics observed and the chemical tests performed. Distance Determination: Methodology: Physical (Visual Examination); Chemical (Color Test Modified Griess/Sodium Rhodizonate); Microscopy (Stereo/Comparison Microscope). Test patterns were submitted at distances of Contact, 3, 6, 9, 12, 15, 18, 21, 24, and 27 inches. The test target media was cloth twill jean. The pattern of gunpowder/gunpowder residues observed and documented from Item 1Q, the cloth twill jean, was reproduced at a muzzle to target distance between 6 and 18 inches. Miscellaneous: Item 1Q1, the test patterns, were sealed in a manila envelope and will be returned with the evidence to the submitting agency. Item K1a, the photographs, were sealed in a manila envelope and will be returned with the evidence to the submitting agency. Item K1b, the photographs, were sealed in a manila envelope and will be returned with the evidence to the submitting agency. Item K1c, the photographs, were sealed in a manila envelope and will be returned with the evidence to the submitting agency.</p>
3VC8R7- 5301	The firearm was separated from the garment at a distance greater than 6" and less than 21" at the time of discharge.
3WKK98- 5305	Fouling was observed visually. Powder grains were observed visually. A wipe-off rim was observed visually. A griess test was performed on defect A entrance and a nitrite pattern was detected that suggests a close approximate muzzle to target distance. The fouling pattern, the powder grain pattern and the nitrite pattern detected on the griess test for defect A entrance on item 4, the section of white shirt, is consistent in diameter and particle population with the fouling patterns, powder grain patterns and nitrite patterns detected from the test fire targets between the distances of 9 inches and 18 inches.

TABLE 2

WebCode- Test	Conclusions
437ZC6- 5305	Examination of the shirt revealed damage (hole#1). Chemical testing and microscopic examination of the area immediately adjacent to the damaged area revealed residue characteristic of a firearms discharge and a firearms projectile entrance hole. Firearms distance determination testing revealed a muzzle to target distance no closer than 3 inches and no further than 15 inches.
484LG8- 5305	The area around the hole in the center of Item 1 (a piece of white fabric) was visually examined and chemically processed for the presence of gunshot residues. The patterns observed on Item 1 were compared to Item 2 (images of known distance patterns). Based on these comparisons, the pattern of residues observed on Item 1 is consistent with being produced at a distance between 3 inches and 18 inches.
4G9WNW- 5305	a. It is extremely probable that the hole in the shirt (Exhibit Q1) is a bullet entrance hole. b. It is highly likely that this bullet was shot at a distance in the range of 6"-18" (muzzle to shirt). This shooting distance estimation is based on the assumption that this target was the first medium hit by the bullet.
4JW9M3- 5301	Request: A request was received from the investigator on 07 APRIL 2021 to conduct Range Estimation examinations on Item Q1 in accordance with the directions contained within CTS Test No. 21-5301 GSR Distance Determination proficiency test. The aim was to compare the recovered victim's shirt with the distance standards provided to estimate the distance of the muzzle of the firearm from the shirt based on the scenario provided. Examinations: Nil test firings were required as these were provided as photo images of the untreated (raw) test firings, Modified Griess Test results and Sodium Rhodizonate results at ranges between 0" and 27" at three inch increments. Item Q1 contained 1 x section of white fabric with an apparent bullet hole. A visual examination of the pattern of residues on the untreated item (raw) was conducted. Item Q1 was also chemically treated using the Modified Griess Test to examine the nitrites pattern, and then chemically treated using the Sodium Rhodizonate test to examine for any vapourous or particulate lead. The untreated (raw), nitrite and lead patterns were then compared to the test firing images provided and a subjective comparison made to estimate the muzzle to target distance. Results: Untreated (raw) - based on visual comparison to the test firings, the questioned fabric exhibits a pattern between 9" and 15". Nitrite - based on visual comparison to the test firings, the questioned fabric exhibits a pattern between 12" and 18". Lead - the test firings showed that vapourous lead deposition dropped off at 18". Item Q1 exhibited a vapourous lead pattern, therefore the maximum muzzle to target distance is 18". Based on visual comparison to the test firings, the questioned fabric exhibits a pattern between 9" and 15". Conclusion: Based on subjective visual and chemical enhancement comparison examinations, including the Modified Griess test for Nitrites and the Sodium Rhodizonate test for Lead, it is my opinion that the estimated muzzle to target distance lies between 9" and 18". Note: This opinion assumes that the test firings were conducted in a manner comparable to the alleged case circumstances.
4THA7X- 5301	The Item Q1 piece of shirt was visually inspected, stereoscopically examined and chemically processed for the presence of gunshot residues. The Item Q1 piece of shirt was examined and found to have a centrally located defect. Visual and stereoscopic examination revealed a pattern of particles consistent with that of propellant around the defect. Vaporous residue was visible around the defect. Based on the presence of powder particles and bullet wipe, the defect is consistent with an entrance hole. The defect and pattern were diagrammed and mapped for comparison purposes. The piece of shirt was chemically processed for the presence of nitrites using the Modified Griess Test. A pattern of nitrites was obtained from the defect. The piece of shirt was then chemically processed for the presence of lead using Sodium

TABLE 2

WebCode- Test	Conclusions
	Rhodizonate. A vaporous lead residue was observed around the defect. Comparison of the patterns observed visually and chemically from Item Q1 to known distance patterns (Item K1a, Item K1b and Item K1c) determined that the residue pattern found around the defect in Item Q1 is consistent in pattern size and density with having been produced at a muzzle-to-target distance between 6 inches and 18 inches.
68XU3V-5301	The area around hole A on the submitted portion of white cloth (item 1A) was microscopically examined and chemically processed for the presence of gunshot residues. A pattern of residues was observed. Using the provided photographs of tests at known distances (items 1B, 1C, and 1D) the pattern on item 1A is most consistent with those produced between 6 and 24 inches.
6CRNZW-5301	The defect in the piece of fabric, item Q1, was consistent with the passage of a bullet. The presence of lead residues, soot, and powder particles was consistent with a muzzle-to-target distance of intermediate. Based on the submitted test panels, items K1a through K1c, drop-off distance is beyond 27". Note: drop-off distance is defined as the maximum distance that gunshot residue particles will be deposited barring the presence of an intervening object.
6G32HV-5301	Using the distance standards listed under Items K1a-c, the pattern of residues on Item Q1 was reproduced at a muzzle distance of approximately six (6) to fifteen (15) inches.
6TGYMY-5301	As a result of the examinations and chemical tests performed, the muzzle to target distance for H1 is greater than 6 inches and less than 18 inches.
6V6BL6-5301	Item 1 was physically and chemically processed for the presence of gun shot residue patterns. The developed pattern sizes are most consistent with the known patterns found in between the 12" and 21" provided standard sets.
6XCQVW-5301	The results obtained indicate that the shooting distance could be less than 18 inches and greater than 9 inches.
6ZD4QV-5301	Most probably in a rank between 9" and 12"
7BATK3-5301	Visual examination and chemical processing of the submitted item Q1 in comparison to submitted standards put the muzzle of the firearm further than 12 inches and less than 21 inches from the t-shirt at the time of discharge.
7TUKJ2-5305	Examination of the shirt revealed damage (hole #1). Chemical testing and microscopic examination of the area immediately adjacent to the damaged area revealed residue characteristic of a firearms discharge, as well as a firearms projectile entrance hole. Firearms distance determination testing revealed a muzzle to target distance no closer than 3 inches and no further than 15 inches.
7VEYZ2-5301	Gunshot residue and sodium rhodizonate patterns similar to the pattern appearing on the shirt marked Q1 were similar at a distance greater than 12" and less than 21".
8796GZ-5301	The area around Hole 1 was microscopically examined and chemically processed for the presence of gunshot residues. Residues were found which are consistent with the passage of a bullet and the discharge of a firearm. Using the Glock 17 with Winchester 9mm 147 grain FMJ ammunition, this pattern of residues was reproduced at a distance of between approximately 9 inches and 21 inches.
8B4YD2-5301	[No Conclusions Reported.]
8BBDZV-5301	The area around defect A was visually examined, microscopically examined and chemically processed for the presence of gunshot residues. The pattern of gunshot residues around defect

TABLE 2

WebCode-Test	Conclusions
8FJ722-5301	A is consistent with a muzzle to target distance between 6 inches and 18 inches.
8NVT4U-5301	The area around Hole 1 in Item 4 was microscopically examined and chemically processed for the presence of gunshot residues. Residues were found which are consistent with the passage of a bullet and discharge of a firearm. Using the Glock 17 pistol, with a 5" Bear Creek Arsenal aftermarket barrel and Winchester 9mm 147 grain FMJ ammunition, this pattern of residues was reproduced at a distance of between approximately 9 inches and 21 inches.
9448XX-5301	<p>After comparing the pattern in item 1.1 to the standards provided, the pattern in item 1.1 can be reproduced at distances of greater than six (6) inches and less than eighteen (18) inches.</p> <p>Clothing Analysis: Methodology: Physical (Visual Examination); Chemical (Color Test Modified Griess/Sodium Rhodizonate); Microscopy (Stereo Microscope). The defect/hole, designated as "A", measured approximately 1/2 inch in greatest dimensions and was located in the center of the white cloth. Visual/microscopic examination of defect/hole "A" revealed the presence of apparent bullet wipe/soot/gunpowder. The patterns of apparent soot/gunpowder measured approximately 4 inches around defect "A". Chemical testing of defect/hole "A" indicates the presence of *nitrite residues/**lead residues. Note: *Nitrites are present in gunpowder residue. **Lead residue can be present in bullets/bullet cores and ammunition primers.</p> <p>Opinion/Interpretation: Examination of defect/hole "A" indicated that it was visually consistent with the passage of a projectile/bullet based upon the physical characteristics observed and the chemical tests performed. Distance Determination: Methodology: Physical (Visual Examination) Chemical (Color Test Modified Griess/Sodium Rhodizonate) Microscopy (Comparison Microscope) The pattern of gunpowder/gunpowder residues observed and documented from Item Q1, defect A, the white cloth, was reproduced at a muzzle to target distance between 6 and 18 inches. The chemical residue pattern residues observed and documented from Item Q1, defect A, the white cloth was reproduced at a muzzle to target distance between 6 and 18 inches. Miscellaneous: Item Q1, the chemical test patterns, will be sealed in a manila envelope and will be returned with the evidence to the submitting agency. Item K1a, the photographs, will be sealed in a manila envelope and will be returned with the evidence to the submitting agency. Item K1b, the photographs will be sealed in a manila envelope and will be returned with the evidence to the submitting agency. Item K1c, the photographs will be sealed in a manila envelope and will be returned with the evidence to the submitting agency. Evidence in this case will be returned to the investigating agency.</p>
9RQCRT-5305	[No Conclusions Reported.]
A2V7YQ-5305	The hole located on the received piece of fabric (from the shirt Q1) was produced by the entry of a ballistic projectile fired at a distance above 6 inches and less 15 inches approximately, based in the results from the gunshot residues testing of the received fabric and their comparison with the received distance standards.
A69EDV-5301	During the optical and chemical examination of the bullet hole, propellant residue was found surrounding the hole. Shot range determination tests were performed with the distance standards at 3 inch increments from contact to 27 inches provided as images of GSR patterns on untreated white cotton cloths, Modified Griess Test and Sodium Rhodizonate chemical treatments. Test shots were fired with the exhibit 9mm Parabellum calibre Glock 17 self-loading pistol, nil serial number, using ammunition with simiar specifications to the Winchester 147 grain FMJ bullet recovered from the victim. This indicates that the shot was fired at a distance of between 9 inches to 21 inches.

TABLE 2

WebCode- Test	Conclusions
ATZCFT- 5301	The defect to the white cloth submitted as Item Q1 exhibited gunshot residues consistent with an intermediate muzzle-to-target distance.
B3K3EP- 5301	The piece of white cloth with a hole in it (Item Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was observed. Utilizing the submitted known distance standards (Items K1a, K1b, and K1c), this pattern of gunshot residues is consistent with a muzzle to garment distance of greater than three inches but less than fifteen inches.
BALNDZ- 5305	The presence of fouling and the powder grain pattern detected on the section of white fabric labeled Q1, and the nitrite pattern detected on the griess test for defect A entrance on the section of white fabric labeled Q1 are consistent in diameter and particle population with the image set of test fire targets (item 1) and the nitrite pattern observed on the griess test images (item 2) between the distances of 9 inches and 18 inches.
BPBJGV- 5301	During the examination of Item 001-Q1, I observed a circular defect along with a pattern of soot and partially burned and unburned gunpowder particles in the center of the panel. The area around the defect was microscopically examined and chemically processed for the presence of gunshot residue patterns. The patterns observed during the microscopic examination and the chemical processing of Item 001-Q1 were compared to the photos of the patterns developed from the set of known panels (Items 001-K1a through 001-K1c). Based on these comparisons I determined the firearm was discharged at an approximate muzzle-to-target distance of greater than six (6) inches and less than eighteen (18) inches.
BPYMBQ- 5301	Item 4 is a piece of white cotton twill with a suspect bullet hole located in the approximate center. The area around the suspect bullet hole was microscopically examined and chemically processed for the presence of gunshot residues. Using the provided standards (Items 1 through 3), the muzzle to target range was determined to be between 3 and 18 inches.
BV3UQT- 5301	The muzzle-to-garment distance for the hole in the Item Q1 cotton cloth was determined to be greater than 6 inches and less than 15 inches.
BXTR6R- 5301	Item 1D (CTS Q1) was examined visually and processed chemically for the presence of gunshot residue. Residues were noted and it was determined that the muzzle to target distance was greater than 6 inches but less than 15 inches from target.
C7ZU4X- 5301	The area surrounding the defect on evidence Item Q1 was visually and chemically examined for the presence of gunshot residues. This examination revealed the presence of gunshot residues. Using the provided Distance Standards, Items K1A - K1C, the gunshot residue pattern identified surrounding the defect on Item Q1 could be reproduced at a muzzle to target distance greater than six (6) inches and less than fifteen (15) inches $\pm 7/16$ " with a confidence level of approximately 95% (k=2). All items of evidence are being returned.
CMM8GP- 5301	The swatch of white cloth from item Q1 was visually examined. A single hole was located in the approximate center of the swatch. The area around the hole was visually and microscopically examined and chemically processed for the presence of gunpowder and lead residues. Residues consistent with the discharge of a firearm were observed and chemical patterns were developed. The resulting patterns from this processing were compared to patterns developed from proximity tests and provided as items K1(a-c). These comparisons showed that the pattern of gunpowder residue on the swatch of item Q1 is consistent with a shot fired from between twelve (12) and twenty-four (24) inches.
D3VDRU- 5301	The shirt was separated from the muzzle of the firearm by a distance that was greater than 3 and less than 18 inches at the time of discharge.

TABLE 2

WebCode-Test	Conclusions
ERBT2M-5305	The questioned Q1 pattern was compared against the K1a-c known standards and it was determined that the questioned pattern was produced at a muzzle to target distance of between 12 inches to 24 inches.
EVC8VM-5305	Comparison of Q1 with the distance standards (untreated) indicates that the shot was fired between 6" and 18" (inches) away (muzzle to fabric distance).
EW63HV-5305	No blast destruction was observed visually. Light fouling was observed visually and with infrared light. Powder grains were observed visually and with stereomicroscopy. A wipe-off rim was observed visually and with infrared light. A griess test was performed on defect A entrance and nitrites were detected. The presence of fouling and the powder grain pattern detected on the section of white fabric labeled Q1, and the nitrite pattern detected on the griess test for defect A entrance on the section of white fabric labeled Q1, are consistent with the presence of fouling and powder grain patterns observed on item 1, the image set of test fire targets, K1a, and the nitrite patterns detected on item 2, the image set of test fire targets treated with the griess test, K1b, between the distances of greater than 6 inches and less than 18 inches.
F9PPUL-5301	The powder pattern on the shirt (item Q1) was compared with the series of test firings and I estimate the shot was fired from a distance of between 15" and 21".
FJX6ZU-5301	1) A hole of entry, vaporous lead, and a pattern of gunpowder, all associated with the discharge of a firearm, were located on Exhibit 2 (Piece of Fabric), and are consistent with characteristics observed at a close range of fire.
FK4MYP-5301	<p>RESULTS AND CONCLUSIONS: The following results and conclusions are based upon direct analysis, measurements, and examination by the reporting scientist and reviewed by the scientist performing the technical and administrative review. Clothing Analysis: Methodology: Physical (Visual Examination); Chemical (Color Test Modified Griess/Sodium Rhodizonate); Microscopy (Stereo Microscope). Examination of Item Q1, the cotton twill jean (white cloth), revealed the following: No visible red-brown stains were observed on Item Q1, the cotton twill jean (white cloth). One (1) defect was observed on Item Q1 and described as follows: The defect/hole, designated as "A", measured approximately 1/4 inch in greatest dimensions and was located approximately 4 1/2 inches from top of fabric and 3 1/4 inches from the left side of fabric on the anterior portion of the cloth. Visual/microscopic examination of defect/hole "A" revealed the presence of apparent bullet wipe/soot/gunpowder. Chemical testing of defect/hole "A" indicates the presence of nitrite residues/lead residues which are found in gunpowder residue. Note: *Nitrites are present in gunpowder residue. **Lead residue can be present in bullets/bullet cores and ammunition primers. Opinion/Interpretation: Examination of defect/hole "A" indicated that it was visually consistent with the passage of a projectile/bullet based upon the physical characteristics observed and/or the chemical tests performed.</p> <p>Distance Determination: Methodology: Physical (Visual Examination); Chemical (Color Test Modified Griess/Sodium Rhodizonate); Microscopy (Stereo/Comparison Microscope). Item K1a, the photographs of white cloth, was test fired at distances of contact, 3, 6, 9, 12, 15, 18, 21, 24, and 27 inches with laboratory and/or submitted ammunition. The test target media appeared to be twill. The test targets were chemically analyzed for gunpowder residues (Items K1b and K1c). The pattern of gunpowder/gunpowder residues observed and documented from Item Q1, the cotton twill jean (white cloth), and Q1A, the chemical analysis of defect/hole "A", were reproduced at a muzzle to target distance between 9 and 21 inches. Miscellaneous: Item Q1A, the chemical test pattern will be sealed in a manila envelope and returned with the evidence for possible future analysis. Item K1a, the photographs of test patterns will be sealed in a manila envelope and returned with the evidence for possible future analysis. Item K1b, the photographs of chemical test patterns will be sealed in a manila envelope and returned with</p>

TABLE 2

WebCode- Test	Conclusions
	the evidence for possible future analysis. Item K1c, the photographs of chemical test patterns will be sealed in a manila envelope and returned with the evidence for possible future analysis. Evidence in this case will be returned to the investigative agency.
G3HHRN-5301	Item 1 was found to consist of a piece of white fabric with an apparent bullet hole in the centre. Test firings from a suspect firearm were also submitted. Black to light grey residue was evident around the hole extending out to approximately 9cm. Unburnt propellant particles were also present extending out to approximately 12cm. Chemical testing indicated that this pattern of firearm discharge residue was consistent with the discharge of the firearm in question at a distance between 9 inches and 21 inches from the fabric.
H4TKDM-5305	Observations and comparisons between shirts allow us to estimate the distance of the muzzle of the firearm from the shirt greater than 12" and less than 18". However an interpretation can be made by knowing elements of the investigation. Therefore, all new data may have an effect on the interpretation of analytical results.
H7GWDT-5301	The area around the hole defect in Item 1 was visually and microscopically examined and chemically processed for muzzle residues, and a centrally dense pattern of muzzle residues consistent with an intermediate close range, but greater than contact/close contact, gunshot was observed. When compared to the Item 2, 3, and 4 test patterns, the muzzle residues on Item 1 were determined to have been fired at a distance greater than 6 inches and less than 21 inches.
HA2F8H-5301	Examination of Item Q1 (white cloth with bullet hole) disclosed one questioned hole which was identified as being caused by the passage of bullet based on numerous gunshot residue (GSR) observed near and around the hole. Using item K1 (known pistol) along with laboratory stock ammunition, Item K1 was test fired at various distances into similar white cloth material. Based on the test firings, it was determined that the questioned bullet hole found on Item Q1 was consistent with being fired at a distance of greater than 9 inches and less than 15 inches.
HM6AQK-5301	The area around defect A was visually examined and microscopically examined for the presence of gunshot residues. The pattern of gunshot residues around defect A is consistent with a muzzle to target distance between 9 inches and 24 inches.
HQM4ER-5301	The area around Hole #1 in Item 4 was microscopically examined and chemically processed for the presence of gunshot residues. Residues were found consistent with discharge of a firearm and passage of a bullet. Using the Glock 17 handgun with Winchester 9mm 147 grain FMJ ammunition, this pattern of residues was reproduced at a distance between approximately 12 inches and 24 inches.
HX7URR-5305	Q1 is consistent with the passage of a bullet with a muzzle to target distance that is between 9 and 21 inches. This distance was determined using the distribution of the burned powder from the Modified Griess tests and the presence of lead using Sodium Rhodizonate on Q1 with the known distances provided.
J92Z8Q-5301	According with the tests made in our Lab, we could come to the conclusion that the shooting might have been produced between 12 and 21".
JEAQPG-5301	The area around Hole A on Item Q1 was microscopically examined and chemically processed for the presence of gunshot residues. A pattern of residues was observed. Using known photographs (Items K1a, K1b, and K1c) a similar pattern of residues was reproduced between 6 inches and 24 inches.
JGU8RG-5301	The area around the hole in the Item 1 shirt was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of Nitrite and lead residues was

TABLE 2

WebCode- Test	Conclusions
	found. The pattern of residues present on the Item 1 shirt was reproduced at a muzzle-to-target range of greater than contact and less than twelve inches when compared to the submitted distance standards.
JGX3PM-5305	The cloth was visually and chemically examined for gunshot residue patterns. The results from the visual and chemical treatment of the item Q1 was compared with test samplings. The result shows that the shooting distance is estimated to be greater than 6" but less than 21".
JNEX6G-5301	The residue pattern indicates a muzzle-to-target distance between nine (9) and eighteen (18) inches.
JXLDBP-5301	Gunshot residue patterns similar to the pattern appearing on the shirt marked Q1 were produced at a distance greater than 9 inches and less than 18 inches.
KLMZQJ-5305	The distance of firing between muzzle of the firearm and the victim's portion shirt, was estimated between 9 and 15 inches.
KMFK6P-5305	The presence of light fouling and the powder grain pattern detected on the section of white fabric labeled Q1, (item 4), and the nitrite pattern detected on the griess test for defect A entrance on the section of white fabric labeled Q1, (item 4), are consistent in diameter and particle population with the light fouling and the powder grain patterns observed on item 1, the image set of test fire targets, K1a, and the nitrite patterns detected on item 2, the image set of test fire targets treated with the griess test, K1b, between the distances of greater than 12 inches and less than 21 inches.
KMZ4CG-5301	The area around the questioned hole in the shirt, Item Q1, was microscopically examined and chemically processed for the presence of gunshot residues. Visible residues indicative of the passage of a bullet were found around the hole during a microscopic examination prior to chemical processing. Patterns of nitrite and lead residues were chemically detected on Item Q1 and compared with the distance standards provided for evaluation. Based on the presence, overall pattern, and density of residues observed between Item Q1 and the provided photographs of the distance standards, the questioned bullet hole on Item Q1 appears to have been created by a shot fired at a distance of greater than six (6) inches but less than fifteen (15) inches from the shirt. This is a conservative estimate based on an evaluation of the untreated and chemically processed residue patterns and assumes there were no intervening objects between the muzzle of the firearm and the shirt at the time the shots were created. This estimated range is also predicated on the submitted distance standards being an accurate representation of the range of variation exhibited by the entire set of original test standards.
KW6GJP-5301	1. Examination of Exhibit 2 disclosed a shirt with a perforating defect near the center of the fabric. a. The area around the hole was visually and microscopically examined. b. Physical characteristics and a pattern of gunshot residues associated with the discharge of a firearm were located. These characteristics are consistent with a close range of fire.
L6ABQM-5301	The following item was visually and microscopically examined: Exhibit 1: Cloth with hole 1. Visual examination of Exhibit 1 revealed a rectangular cloth punctured near the center by a single hole, which was immediately surrounded by a ring of dark soot. A pattern of burned and partially burned gunpowder particles as well as soot residues were visible on the cloth around the hole. 2. The characteristics observed on Exhibit 1 are consistent with those that are observed in gunshots known to be made from a close range of fire. Technical Notes: Contact or Near Contact is defined as when the muzzle of the firearm is in/near contact with the target at the time of discharge. Close is defined as the range of fire at which a firearm and ammunition combination will deposit a pattern of gunpowder or vaporous lead on a target. Undetermined is defined as when a specific muzzle to target distance could not be determined

TABLE 2

WebCode-Test	Conclusions
	due to a lack of defined gunshot residue patterns. This may indicate the shot was discharged from a distance beyond the maximum distance for the deposition of residues, an intervening object was present at the time of discharge, or that residues were lost during handling of the item prior to examination.
LNPKRN-5301	The area around the hole in Item 2 was microscopically examined and chemically processed for a pattern of residues. Residues like that observed on Item 2 were reproduced in Item 1 at a minimum distance of 6 inches and a maximum distance of 21 inches.
LPX2YE-5301	GSR pattern on item Q1 revealed that the bullet fired at item Q1 was fired at a distance between 12 inches to 21 inches.
LV44BM-5301	1) The Exhibit 1 cloth tested positive for gunpowder, copper, and lead, and was consistent with a perforating bullet impact. 2) The Exhibit 1 cloth had a muzzle to target distance of greater than 6 inches, but less than 18 inches.
M3KYRH-5301	The item Q1 section of cloth displayed one (1) hole that appeared to have been made by the passage of a bullet. The hole will be referred to as hole 1. The areas around the hole were examined visually and microscopically for the presence of gunpowder particles. Gunpowder particles were found all around the hole. Item Q1 was tested chemically using the Modified Griess Test and the Sodium Rhodizonate Test. The Modified Griess Test and the Sodium Rhodizonate test are color-producing tests for the presence of nitrites (burned or partially burned gunpowder) and lead, respectively, found in gunshot residues. A particulate nitrite pattern was detected around hole 1. A vaporous lead pattern was also developed around hole 1. Using the supplied photographs of the test shots, the photographs of the results of the Modified Griess test and the Sodium Rhodizonate tests, the distance from the muzzle of the suspect firearm to item Q1 was determined to be greater than 6" and less than 15".
MDK24L-5301	Examination of Item 4 revealed a hole in the center of the cloth. The area surrounding the hole was visually and microscopically examined and chemically processed and a pattern of gunshot residues was detected. The detected pattern surrounding the hole in the center of Item 4 is consistent in size, density, and appearance to the photographs of test patterns produced at muzzle-to-target distances of between six (6) and eighteen (18) inches. This range was determined by examining Item 4 and the submitted photo arrays which represent test patterns at known distances.
MG2WWH-5301	The clothing was treated using the standard Na-Rhodizonate test. Using this test the presence of bi-valent metallic elements can be shown. As in classic GSR particles both lead and barium will be colored using this test, the distribution of GSR particles around the entrance hole can be observed. From the observed pattern on the clothing it is clear that a shooting occurred at a distance smaller than 80 inches. Using the provided photographs of reference shots at known distances, it can be further estimated that the shooting was not a contact shot, but took place at a muzzle to target distance larger than 6 and smaller than 18 inches.
MK29TH-5305	The distance of firing between the muzzle of the firearm and the shirt marked "Q1" was estimated to be between 6 inches to 18 inches.
MMP9HL-5301	In my opinion, the shot was fired when, at the moment of discharge, the muzzle of the gun was greater than 9 inches from but within 18 inches of the victim's shirt.
NBUPUK-5305	Item 1 consists of distance standards at 3 inch increments from contact to 27 inches provided as images of GSR patterns on untreated white cotton cloths, modified griess tests and sodium rhodizonate chemical treatments. Item 2 is a white colored piece of fabric with an apparent bullet hole. The area around the hole was microscopically examined and chemically processed

TABLE 2

WebCode-Test	Conclusions
	for the presence of gunshot residues, and a pattern of residues was found. Using the provided distance standards (Item 1), this pattern of residues was reproduced at a distance greater than contact and less than fifteen inches.
NC6PQE-5305	In the study was determined distance short with a range greater than 15 inches and less than 24 inches approximately between the muzzle of the weapon and impact site over the shirt. This information based on the comparison between distance of standars and the sample.
NHT8UC-5301	The area around the hole in the Item 2 shirt was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of Nitrite and lead residues was found. Utilizing the Item 1 test patterns for comparison, the muzzle-to-target range for residues present on the Item 2 shirt was determined to be greater than three and less than fifteen inches. No other residues were detected.
P3VCWC-5305	The pattern of residue on the white cloth originated from a distance farther than approximately 12 inches and closer than approximately 24 inches.
PEQTYC-5301	Item A1-1 (Q1): Examination of the Item A1-1 (Q1) piece of fabric revealed the presence of a hole, consistent with a bullet hole, through the fabric. The area around this hole was examined microscopically, and processed chemically for the presence of propellant and lead residues (gunshot residues), and a pattern of residues was found. Comparison of the Items A1-2 (K1a), A1-3 (K1b) and A1-4 (K1c) submitted test patterns to the item A1-1 (Q1) submitted piece of fabric, showed the Item A1-1 (Q1) residue pattern to be consistent in size and density with patterns observed on the items A1-2 (K1a), A1-3 (K1b) and A1-4 (K1c) submitted standards. Based on this comparison, the bullet hole observed on Item A1-1 (Q1) is consistent with a shot fired from a distance between approximately nine (9) inches, and approximately twenty four (24) inches from muzzle to target.
PGCA2C-5301	we apply color test technique on the shirt sample (Q1) using fresh modified griss and we conclude that there is nitrite anion which give indication of the presence of close shooting. By comparing the result obtained above we can estimate the distance of the muzzle of the firearm from the shirt was between ( 9-15 ) inches .
PJXJ2H-5305	The portion of white shirt was visually, microscopically and chemically examined with the following results: A single defect consistent with the passage of a fired bullet was observed on Item 1.1 surrounded by gunshot residues. The patterns of gunshot residues on Item 1.1 were compared to photographs of test panels indicating a minimum muzzle to target distance of 9 inches and a maximum distance of 18 inches.
PKBLXC-5305	After doing physical & chemical examinations it was observed that the distance range from the muzzle of the firearm to the target was greater than 9 inch & less than 15 inch.
PQ6Q4F-5305	Test residue of shooting with positive result - (Gunshot residue POSITIVE). The shot was made at close range, varying from 9 to 15 inches.
PVF4LE-5305	"Test Powder:" The T-shirt placed with seal No. X has a ballistic hole. The characteristics of this orifice are compatible with the passage of a 9 mm caliber projectile. We observe the presence of powder and smoke residues around the inlet opening. We carried out test shots at different distances, on a sample of the same type in tissue with the weapon placed under seal No. X and with ammunition whose bullet is of the same type as that discovered during the events. After comparing the distribution of unburnt powder grains and smoke with our test results and the T-shirt We can estimate that the recorded shot distance is between 12 and 15 inches.
QCJXTE-5305	The range of distance between the muzzle of the firearm and the impacted garment is: between (6) six inches and (15) fifteen inches.

TABLE 2

WebCode- Test	Conclusions
QL62ZE- 5301	The end of the barrel of the firearm was at a distance of 9 inches to 18 inches from the victim's shirt when the shot was fired.
R83P6E- 5301	Item Q1 was visually and microscopically examined; one hole was located. The area around the hole was chemically processed for the presence of gunshot residues; residues consistent with the discharge of a firearm and passage of a bullet were found. The gunshot residue pattern around the hole is consistent with tests fired at a muzzle to target distance greater than 6 inches and less than 21 inches, based on comparisons to knowns fired using the same firearm and ammunition.
RCF3W9- 5301	The hole H1 was examined and found to be entrance hole made by a firearm projectile while the item Q1 shirt was at the distance of between approximately nine inches to twenty one inches from the muzzle of the firearm at the time of firing.
RPF49A- 5301	Test patterns were fired using the 9mm Luger caliber Glock semiautomatic pistol serial number XXXX. The distance was measured from the muzzle to the target. Patterns like the pattern appearing upon the item Q1 shirt were produced at a distance greater than eight (8) inches and less than twenty (20) inches.
RUTAXA- 5301	Examination of the Item A1-4 piece of fabric revealed the presence of a hole, consistent with a bullet hole, through the fabric. The area around this hole was examined microscopically, and processed chemically for the presence of propellant and lead residues (gunshot residues), and a pattern of residues was found. Comparison of the Items A1-1, A1-2, and A1-3 submitted test patterns to the Item A1-4 submitted piece of fabric, showed the Item A1-4 residue pattern to be consistent in size and density with patterns observed on the Items A1-1, A1-2 and A1-3 submitted standards. Based on this comparison, the bullet hole observed on Item A1-4 is consistent with a shot fired from a distance between approximately twelve (12) inches, and approximately twenty four (24) inches from muzzle to target.
RVL7KH- 5301	The area around the suspected bullet hole in Item Q1 was examined visually and processed chemically for a pattern of gunshot residues. A pattern of residues was developed that most resembles the provided test patterns between 6 and 21 inches (as labeled).
TK3BKA- 5305	The shot was fired between a minimum distance of 9 and a maximum of 15 inches.
TLEE69- 5305	According with the distance standards, the hole in the fabric "Q1" was produced by the entry of a ballistic projectile shot at a distance ranging from 9 inches to 15 inches approximately.
TUPGQ9- 5305	By comparing the distribution of gunshot residues around the entry hole in the analyzed sample (ITEM Q1), with the patterns generated with a Glock 17 handgun with a 5" Bear Creek Arsenal aftermarket barrel and an ammunition Winchester 9mm 147 grain FMJ, used to perform the investigated facts, it is possible to conclude that the firing distance ranges between 15 cm (6 inches) and 38 cm (15 inches).
TYZU98- 5301	The area around the hole in the Item 1 shirt was microscopically examined and chemically processed for the presence of gunshot residues, and a pattern of nitrite and lead residues was found. The pattern of nitrite residues present on the Item 1 shirt was reproduced at a muzzle-to-target range of greater than six inches and less than eighteen inches when using the submitted Item 2 distance standards. No other residues were detected.
VGCN37- 5301	The area around the hole in Item Q1 was microscopically examined and chemically processed for gunpowder and lead residues (gunshot residues). A pattern of residues was developed

TABLE 2

WebCode- Test	Conclusions
W9YY3C- 5301	which was compared with distance patterns generated at approximately contact, 3, 6, 9, 12, 15, 18, 21, 24 and 27 inches. The gunshot residue pattern on Item Q1, based on size and density, is consistent with the muzzle of a firearm having been greater than approximately 6 inches and less than approximately 18 inches from this area at the time of firing.
W9YY3C- 5301	Exhibit 1 (Q1) was visually and chemically examined for the presence of gunshot residues. The gunshot residue patterns observed and developed on Exhibit 1 were compared to photographs of gunshot residue patterns at known distances (Exhibits 2-4; K1a, K1b and K1c). The distance range that the muzzle of the firearm could have been from Exhibit 1 at the time of discharge is greater than 6 inches and less than 18 inches.
WJDNP4- 5301	The delivered Item Q1 was first searched for penetrations. Figure 1 shows an identified penetration that, due to shape and size, could be induced by a bullet of caliber 9mm. From the penetration area possible traces of GSR were transferred to a secondary trace carrier, which was subsequently treated with chemographical coloring methods. Firstly the Na-Rhodizonate method was applied. Hereby a bullet wipe ring could be identified as it occurs when a bullet penetrates an object like a fabric. Additionally, cloudy and spot-like colored traces could be identified around the entrance hole. Subsequently, the delivered shirt was investigated regarding potential NC particles using a modified Griess Test. Hereby several colored NC particles could be identified. For the estimation of the shooting distance a comparison shot series was performed using the delivered weapon and ammunition. The treatment of the comparison shots was performed using the same procedures as with the delivered T-shirt. The visual comparison of the archived colored pattern with the comparison shots results in an estimation of a shooting distance in the range of 6 to 15 inches. This statement is made under the assumption that no depletion of GSR has taken place (e.g. by other objects present in the line of fire or by the ablation of GSR by blood or in process of the medical supply).
WMFUH9- 5305	The estimation of the firing distance range in the periphery of the entrance hole present in the cloth cutout item Q1, was established between NINE (9) and FIFTEEN (15) inches, measured from the muzzle of the weapon to the cloth. The above was established by comparison with the CTS photographs received and in accordance with the results of the tests of the physical and chemical study on the fabric.
WPLCF6- 5301	The residue pattern in item 1 indicates a muzzle to target distance between six inches and fifteen inches.
WRANFA- 5301	After visual examination and chemical testing, it was determined that the muzzle to target distance is between 6" and 18".
X2UFE8- 5305	Se establece que la perforación encontrada en el trozo de tela analizado, fue producto del paso de proyectil disparado en arma de fuego de carga única, efectuado entre la boca de fuego del arma y la superficie afectada en un rango aproximado de 9 y 15 pulgadas.
X6TTZC- 5301	1. Examination of the white fabric, Exhibit 2, revealed characteristics consistent with those observed at a close range of fire.
XCX674- 5301	By mean of physical study and chemical analysis, gun shot residues (gun powder, nitrites and lead) were detected around the shirt's (Q1) hole consistent with firing a gun from a muzzle to garment distance between nine (9") inches to eighteen (18') inches. The provided distance standards (K1a, K1b and K1c) were used for distance determination.
Y9UTMA- 5305	Examination of the shirt revealed damage (hole #1). Chemical testing and microscopic examination of the area immediately adjacent to the damaged area revealed residue

TABLE 2

WebCode- Test	Conclusions
YBUPY3- 5301	<p>characteristic of firearms discharge as well as a firearms projectile entrance hole. Firearms distance determination testing revealed a muzzle to target distance no closer than 3 inches and no further than 15 inches.</p> <p>Results and Conclusions: The hole in item Q1 was consistent with the passage of a bullet. The presence of gunshot residues around the bullet hole indicated that the muzzle-to-target distance was intermediate. Drop-off distance can be determined if a suspect firearm is submitted and more test panels are able to be created. Intermediate: The range at which a firearm and ammunition combination will deposit visible or detectible gunpowder particles on a target. Drop-off: The distance where the firearm and ammunition combination will no longer deposit observable/detectible residues on a specific target material. Methods and Observations: The apparent shirt material, item Q1, was examined visually, stereoscopically, and chemically for possible bullet holes and gunshot residues. One bullet hole was observed in the middle of the shirt material. The bullet hole was positive for lead and copper residues. Soot and gunpowder particles were observed visually/stereoscopically and detected chemically. Remarks: The above contains the opinions and interpretations of the analyst whose signature appears on this report.</p>
YDMKLB- 5301	<p>The area around the suspected bullet hole on Item Q1 was microscopically examined and chemically processed and a pattern of residues was found. The pattern on Item Q1 was compared to the photographs of provided known distance patterns depicted in Items K1A, K1B, and K1C. The pattern of residues displayed on Item Q1 most resembles the known distance patterns generated between a minimum distance of 6 inches, and a maximum distance of 18 inches.</p>
YMP9M3- 5301	<p>In my opinion, the muzzle of the gun was between 12 and 24 inches from the T-shirt at the time the shot was fired.</p>
YV2XD2- 5301	<p>The area around the hole in the white cloth (Item Q1) was microscopically examined and chemically processed for the presence of gunshot residues and a pattern of residues was found. Using the known patterns (K1a, K1b and K1c), the pattern of residues was produced at a distance between 12 inches and 24 inches.</p>
Z26TJ2- 5301	<p>One (1) portion of a white shirt having one (1) circular bullet hole approximately 5/16" x 5/16" in diameter. Gunshot residue pattern around the bullet hole approximately 5 1/4" x 5 1/4" in diameter, also bullet wipe and light stippling are present on the shirt. Modified Griess and Sodium Rhodizonate were conducted. Results disclosed, that the muzzle to target was no less than 9" and no greater than 21".</p>
Z6KZ82- 5305	<p>The muzzle of the pistol was most likely between 6 inches and 15 inches from the shirt (Item Q1) at the time of discharge. This was based on comparisons of the appearance and distribution pattern of damage, powder particles, sooting, and lead between the shirt and the supplied distance standard targets (Items K1a-c). Evaluation of the patterns included visual examination and chemical enhancement. This conclusion is based on the assumptions that the supplied targets were produced under the same conditions as the shirt target (Item Q1) and reproducibility of the supplied targets was verified.</p>
ZXAAV3- 5301	<p>Shooting distance has been 15" +-3"</p>

# Additional Comments

TABLE 3

WebCode-Test	Additional Comments
3CXJ7X-5301	The uncertainty of measurement in the creation of known test fire patterns was established for our laboratory. Since we were supplied with test patterns created by CTS, our uncertainty of measurement does not apply and will not be reported.
3ELV74-5301	The Griess results were basically useless for this test as the results were not at all similar to the processed Q1 garment.
3GPQP7-5301	TECHNICAL NOTES: Contact or Near Contact is defined as when the muzzle of the firearm is in/near contact with the target at the time of discharge. Close is defined as the range of fire at which a firearm and ammunition combination will deposit a pattern of gunpowder or vaporous lead on a target. Undetermined is defined as when a specific muzzle to target distance could not be determined due to a lack of defined gunshot residue patterns. This may indicate the shot was discharged from a distance beyond the maximum distance for the deposition of residues, an intervening object was present at the time of discharge, or that residues were lost during handling of the item prior to examination.
4G9WNW-5305	1. The probability scale used in our laboratory for examinations like this is, (in descending order): A. Extremely probable. B. Highly likely. C. Probable. D. Possible. E. Cannot be Ruled Out. 2. The procedures used by the manufacturers of this test, as well as the conditions of the test firing used here, are different from those applied routinely by our laboratory. As a result, the figures quoted for the minimum and maximum shooting ranges may be wider, and the probability, therefore lower. 3. In estimating the shooting distance on this test, we used mainly the test shot results supplied with the proficiency test.
4JW9M3-5301	The modified Greiss test pattern enhancement was less intense for the questioned item than the provided images of the test firings. Whilst this did not inhibit the interpretation, it is curious as to whether this is due to internal processes or time/temperature effects on the questioned sample whilst in transit.
6CRNZW-5301	Greater than and less than fields intentionally left blank on answer page. Bracketing type conclusion based on submitted test panels for proficiency purposes in case file notes was approximately between 6 and 18 inches based on K1a-K1c test panels. Per this agency's technical procedures range bracketing is not typically reported.
A2V7YQ-5305	Some observations and recommendations: 1. Our standard operating procedure (SOP) is different from that used in the processing of fabrics from test firings. Our SOP includes an additional step that consists in a lifting with adhesive plastic sheet to remove gunpowder granules on the fabric. Each adhesive plastic is processed by alkaline hydrolysis of nitrate esters (with heating). Finally, detection is performed with photo paper impregnated with Griess reagent. This procedure was described by the staff of Toolmarks and Materials Laboratory of Division of Identification and Forensic Science Israel National Police Headquarters, in: Glattstein, Baruch & Vinokurov, Asya & Levin, Nadav & Zeichner, Arie. (2000). Improved Method for Shooting Distance Estimation. Part 1. Bullet Holes in Clothing Items. Journal of forensic sciences. 45. 801-6. 10.1520/JFS14773J. Recently this methodology has been recommended by Berger, J.; Upton, C.; Springer, E. (2018). Evaluation of Total Nitrite Pattern Visualization as an Improved Method for Gunshot Residue Detection and its Application to Casework Samples. Journal of Forensic Sciences. 10.1111/1556-4029.13802. That situation influences the comparison of our results with the test distance standards of this proficiency test, principally in the Griess Test. 2. I think it's INDISPENSABLE to review replicates of test distance standards (unprocessed and their rhodizonate/Griess test results) and not only one of

TABLE 3

WebCode-Test	Additional Comments
	them at each distance, for considerate the variability in the gunshot residues deposition on the fabric or surface. 3. I think the test could include some controlled sources of complexity such as other kind of fabrics, dark fabrics, impermeable fabrics; fabrics with two adjacent orifices, etc., for more realistic approach.
ATZCFT-5301	The defect on Item Q1 was visually, microscopically, and chemically processed for the presence of gunshot residues. If a suspected firearm is submitted for examination the drop-off distance for that particular firearm could be determined. Testing to determine the approximate drop-off distance will be conducted in a laboratory setting. A variety of scenario-based variables might affect the evidence which could change the drop-off distance greater than any measurement uncertainty in the performed laboratory tests. Intermediate: The range at which a firearm and ammunition combination will deposit visible or detectible gunpowder particles on a target. Drop-off distance: Drop-off distance is the distance where the firearm and ammunition combination will no longer deposit observable/detectible residues on a specific target material. Gunshot residues: The total residues resulting from the discharge of a firearm. It includes both gunpowder and primer residues, carbonaceous material, metallic residues from projectiles, fouling, and any lubricant associated with the projectiles.
ERBT2M-5305	Obtained weak Griess reaction in comparison to the known standards.
EVC8VM-5305	The Rhodizonate test have not been relied on because it appears the method to generate these may be different from our procedure. The Griess test have not been used as this method is not used in our procedures.
FJX6ZU-5301	TECHNICAL NOTES: Contact or Near Contact is defined as when the muzzle of the firearm is in/near contact with the target at the time of discharge. Close is defined as the range of fire at which a firearm and ammunition combination will deposit a pattern of gunpowder or vaporous lead on a target. Undetermined is defined as when a specific muzzle to target distance could not be determined due to a lack of defined gunshot residue patterns. This may indicate the shot was discharged from a distance beyond the maximum distance for the deposition of residues, an intervening object was present at the time of discharge, or that residues were lost during handling of the item prior to examination.
J92Z8Q-5301	The conclusion indicated in #2 is similar to the one we put in our real reports. None
JGU8RG-5301	Methods: Gunshot Residue. Items submitted for gunshot residue testing are examined visually and microscopically for the presence of suspected bullet holes, physical effects from a firearm discharge such as singeing or tearing of fabric, and embedded particles of gunpowder, lead, and copper. If some or all of these conditions are noted, a series of chemical tests for the presence of nitrites (a component of gunpowder), lead, and copper may be performed. Each of these tests are chemically specific and produce a color reaction when in the presence of the specific chemical. The tests used for nitrite compounds, lead, and copper are the Modified Griess Test, the Sodium Rhodizonate Test, and the Dithiooxamide Test, respectively. If a suspect firearm and ammunition are submitted, test-fired exemplars are created at a variety of muzzle-to-target distances, are visually examined and chemically processed in the same manner as the evidence, and are compared directly with the submitted evidence. When test results at specific distances are distinctly different than the results on the submitted evidence, this is used as the basis for excluding an appropriate range of distances ("could not be reproduced at a distance of four inches or less"). When no suspect firearm and/or ammunition is submitted, results are more general and are based on common maximum distances for the deposition of gunshot residues ("residues like those found on the (Item #) are rarely deposited

TABLE 3

WebCode-Test	Additional Comments
	<p>at a distance of six feet or greater"). If the only reaction produced in testing is a small ring of lead and/or copper around a suspected bullet hole, this is considered consistent with the passage of a bullet, but no distance determination can be made. Limitations: Gunshot Residue. While firearms are known to produce consistent gunshot residue pattern results under controlled conditions, variables including shooting environment, barrel condition and ammunition design can all influence the results of tests conducted on the submitted evidence and test-fired exemplars. Accordingly, gunshot residue test results are primarily used to exclude particular muzzle-to-target ranges and should only be considered valid for the particular combination of firearm and ammunition type used during testing in the Laboratory. The use of the phrase "consistent with" in this report is meant to indicate physical effects that are commonly found in a given shooting environment. No conclusions can be drawn when residues are absent due to the possibility of intervening objects or environmental and handling conditions. When a bullet impacts an intervening object, vaporous lead residue deposits can be produced that are occasionally dispersed onto neighboring items. Distance determinations involving a wound and/or injury are outside the scope of this procedure.</p>
JGX3PM-5305	<p>The laboratory standard procedures is not the same as used in the test samplings. Our standard operating procedures for examination of gunshot damages are: Visual examination, IR-detection, Modified Griess test, DTO for copper and Modified Sodium Sulphite test for lead.</p>
JNEX6G-5301	<p>The uncertainty of measurement in the creation of known test fire patterns was established for our laboratory. Since we were supplied with test patterns created by CTS, our uncertainty of measurement does not apply and will not be reported.</p>
KW6GJP-5301	<p>TECHNICAL NOTES: Contact or Near Contact is defined as when the muzzle of the firearm is in/near contact with the target at the time of discharge. Close is defined as the range of fire at which a firearm and ammunition combination will deposit a pattern of gunpowder or vaporous lead on a target. Undetermined is defined as when a specific muzzle to target distance could not be determined due to a lack of defined gunshot residue patterns. This may indicate the shot was discharged from a distance beyond the maximum distance for the deposition of residues, an intervening object was present at the time of discharge, or that residues were lost during handling of the item prior to examination.</p>
MDK24L-5301	<p>The reported range is conservative and reflects the fact that the analyst only had (1) shot per distance instead of the laboratory practice to take at least (3) shots per distance to verify that the firearm is reproducing patterns. Also the photo paper and reagents used to process Item 4, were not produced at the same time or from the same lot of chemicals as the ones used to produce the photo arrays. If the analyst had additional shots at each distance and all the known standards were processed using the same chemicals as Item 4, the reported range may be smaller.</p>
MG2WWH-5301	<p>Our results for this test are based only on the performance of the Na-Rhodizonate method. We do not perform IR imaging nor Griess reagent testing in our lab. Furthermore, as we do not treat the sheet with acid after Rhodizonate reaction (to eliminate the possible Ba particles), it is possible that we under-estimate the shooting distance, since we see more colored particles than we normally would if only pure lead-containing particles were left over. These effects are taken into account in our regular reporting by stating that we observe the presence of lead-containing GSR particles, and thus conclude that a medium-range shooting distance - larger than a few inches, but smaller than about 80 inch (2m) - was observed. We have found that even this rough estimate suffices to aid police in their inquiries in most cases.</p>

TABLE 3

WebCode- Test	Additional Comments
NHT8UC- 5301	<p>Methods: Gunshot Residue. Items submitted for gunshot residue testing are examined visually and microscopically for the presence of suspected bullet holes, physical effects from a firearm discharge such as singeing or tearing of fabric, and embedded particles of gunpowder, lead, and copper. If some or all of these conditions are noted, a series of chemical tests for the presence of nitrites (a component of gunpowder), lead, and copper may be performed. Each of these tests are chemically specific and produce a color reaction when in the presence of the specific chemical. The tests used for nitrite compounds, lead, and copper are the Modified Griess Test, the Sodium Rhodizonate Test, and the Dithiooxamide Test, respectively. If a suspect firearm and ammunition are submitted, test-fired exemplars are created at a variety of muzzle-to-target distances, are visually examined and chemically processed in the same manner as the evidence, and are compared directly with the submitted evidence. When test results at specific distances are distinctly different than the results on the submitted evidence, this is used as the basis for excluding an appropriate range of distances ("could not be reproduced at a distance of four inches or less"). When no suspect firearm and/or ammunition is submitted, results are more general and are based on common maximum distances for the deposition of gunshot residues ("residues like those found on the (Item #) are rarely deposited at a distance of six feet or greater"). If the only reaction produced in testing is a small ring of lead and/or copper around a suspected bullet hole, this is considered consistent with the passage of a bullet, but no distance determination can be made. Limitations: Gunshot Residue. While firearms are known to produce consistent gunshot residue pattern results under controlled conditions, variables including shooting environment, barrel condition and ammunition design can all influence the results of tests conducted on the submitted evidence and test-fired exemplars. Accordingly, gunshot residue test results are primarily used to exclude particular muzzle-to-target ranges and should only be considered valid for the particular combination of firearm and ammunition type used during testing in the Laboratory. The use of the phrase "consistent with" in this report is meant to indicate physical effects that are commonly found in a given shooting environment. No conclusions can be drawn when residues are absent due to the possibility of intervening objects or environmental and handling conditions. When a bullet impacts an intervening object, vaporous lead residue deposits can be produced that are occasionally dispersed onto neighboring items. Distance determinations involving a wound and/or injury are outside the scope of this procedure.</p>
PGCA2C- 5301	<p>we do an color test of the muzzle by sodiom Rhodizonate and compare the result with (KIs) samples .</p>
PKBLXC- 5305	<p>Physical examinations was done and the outline for the pattern was made on transparent sheet. Photographs were taken throughout the process. Due to the unavailability of the photographic paper, we have given the conclusion on the basis of performing NaRh test only.</p>
PVF4LE- 5305	<p>We cannot perform the Griess and NaRh tests. We do not have this type of reagent, we have never performed this type of analysis in the ballistic section.</p>
QL62ZE- 5301	<p>Visual inspection was closer to 12 to 15 inches. Griess was closer to 12 to 15 inches. Lead was closer to 12 to 15 inches.</p>
RUTAXA- 5301	<p>Item A1-4 is the unknown.</p>
TYZU98- 5301	<p>Methods: Gunshot Residue. Items submitted for gunshot residue testing are examined visually and microscopically for the presence of suspected bullet holes, physical effects from a firearm discharge such as singeing or tearing of fabric, and embedded particles of gunpowder, lead, and copper. If some or all of these conditions are noted, a series of chemical tests for the presence of nitrites (a component of gunpowder), lead, and copper may be performed. Each</p>

TABLE 3

WebCode-Test	Additional Comments
	<p>of these tests are chemically specific and produce a color reaction when in the presence of the specific chemical. The tests used for nitrite compounds, lead, and copper are the Modified Griess Test, the Sodium Rhodizonate Test, and the Dithiooxamide Test, respectively. If a suspect firearm and ammunition are submitted, test-fired exemplars are created at a variety of muzzle-to-target distances, are visually examined and chemically processed in the same manner as the evidence, and are compared directly with the submitted evidence. When test results at specific distances are distinctly different than the results on the submitted evidence, this is used as the basis for excluding an appropriate range of distances ("could not be reproduced at a distance of four inches or less"). When no suspect firearm and/or ammunition is submitted, results are more general and are based on common maximum distances for the deposition of gunshot residues ("residues like those found on the (Item #) are rarely deposited at a distance of six feet or greater"). If the only reaction produced in testing is a small ring of lead and/or copper around a suspected bullet hole, this is considered consistent with the passage of a bullet, but no distance determination can be made. Limitations: Gunshot Residue. While firearms are known to produce consistent gunshot residue pattern results under controlled conditions, variables including shooting environment, barrel condition and ammunition design can all influence the results of tests conducted on the submitted evidence and test-fired exemplars. Accordingly, gunshot residue test results are primarily used to exclude particular muzzle-to-target ranges and should only be considered valid for the particular combination of firearm and ammunition type used during testing in the Laboratory. The use of the phrase "consistent with" in this report is meant to indicate physical effects that are commonly found in a given shooting environment. No conclusions can be drawn when residues are absent due to the possibility of intervening objects or environmental and handling conditions. When a bullet impacts an intervening object, vaporous lead residue deposits can be produced that are occasionally dispersed onto neighboring items. Distance determinations involving a wound and/or injury are outside the scope of this procedure.</p>
WJDNP4-5301	<p>According to the SOPs that are used in our lab, the coloring process is not directly performed on the fabrics (case shot and comparison shot series). A secondary trace carrier is used which is desensitized photo paper in the case of Sodium Rhodizonate treatment, and adhesive transparency film for the NC verification (following the method of B. Glatstein et al.). These circumstances may lead to a different distance estimation (as the case shot was treated according to our SOP and not colored directly on the fabric as done with the provided comparison shots). This was taken into consideration by using wider error ranges when estimating the range margins.</p>
WPLCF6-5301	<p>The uncertainty of measurement for the creation of known test fire patterns was established for our laboratory. Since we were supplied with test patterns created by CTS, our uncertainty of measurement does not apply and will not be reported.</p>
X6TTZC-5301	<p>Contact or Near Contact is defined as when the muzzle of the firearm is in/near contact with the target at the time of discharge. Close is defined as the range of fire at which a firearm and ammunition combination will deposit a pattern of gunpowder or vaporous lead on a target. Undetermined is defined as when a specific muzzle to target distance could not be determined due to a lack of defined gunshot residue patterns. This may indicate the shot was discharged from a distance beyond the maximum distance for the deposition of residues, an intervening object was present at the time of discharge, or that residues were lost during handling of the item prior to examination.</p>
YBUPY3-5301	<p>Our laboratory procedures do not allow for reporting a range.</p>

TABLE 3

<b>WebCode- Test</b>	<b>Additional Comments</b>
YMP9M3- 5301	The availability of additional test cards at each distance to determine reproducibility of soot deposits at each distance may allow estimated range to be narrowed down further.
Z6KZ82- 5305	The distribution of sooting, powder particles, and lead residues was uneven, giving the appearance the pistol's barrel was not perpendicular to the shirt, the shirt was not flat, or air current influence occurred at the time of discharge.

-End of Report-  
(Appendix may follow)

## Test No. 21-5301: GSR Distance Determination

DATA MUST BE SUBMITTED BY **May 10, 2021, 11:59 p.m.** TO BE INCLUDED IN THE REPORT

Participant Code: U1234A

WebCode: 87U94L

The Accreditation Release section can be accessed by using the "Continue to Final Submission" button above. This information can be entered at any time prior to submitting to CTS.

### Scenario:

Police are investigating a shooting at a nightclub. The victim's shirt was cut and removed by paramedics. The portion of the shirt with the bullet hole was recovered and is being submitted for examination. The coroner confirmed that no exit hole was present on the victim. A suspect was apprehended later that day and the police seized a Glock 17 handgun with a 5" Bear Creek Arsenal aftermarket barrel from his possession. The bullet recovered from the victim was identified as having come from the suspect's firearm. Rounds of Winchester 9mm 147 grain FMJ (which was consistent with the bullet recovered from the victim) were test fired with the suspect firearm and the distance standards prepared. Investigators are asking you to compare the recovered victim's shirt with the distance standards provided to determine the distance of the muzzle of the firearm from the shirt.

Please note the following:

-The Modified Griess treatment was performed in accordance to the following article:

Dillon, J.H. (1990) *The Modified Griess test: A chemically specific chromophoric test for nitrite compounds in gunshot residues.* AFTE J. 22(3), 243-250.

-The Sodium Rhodizonate treatment was performed in accordance to the following article:

Dillon, J.H. (1990) *The Sodium Rhodizonate Test: A chemically specific chromophoric test for lead in gunshot residues.* AFTE J. 22(3), 251-256.

### Items Submitted (Sample Pack GSRP - Photographs):

Item K1a-c: Distance Standards at 3 inch increments from Contact to 27 inches provided as images of GSR patterns on untreated white cotton cloths, and Modified Griess Test and Sodium Rhodizonate chemical treatments.

Item Q1: Shirt with bullet hole.

**1.) What is the distance range that the muzzle of the firearm could have been from the shirt (Q1) at the time of discharge? Please report a numeral response (e.g. 6) from the supplied Distance Standards. If reporting Contact, indicate with the numeral 0.**

Greater than  (inches) and Less than  (inches)

*Please note: Any additional formatting applied in the free form spaces below will not transfer to the Summary Report and may cause your information to be illegible. This includes additional spacing and returns that present your responses in lists and tabular formats.*

**2.) What would be the wording of the Conclusions in your report?**

**3.) Additional Comments**

## RELEASE OF DATA TO ACCREDITATION BODIES

The Accreditation Release is accessed by pressing the "Continue to Final Submission" button online and can be completed at any time prior to submission to CTS.

CTS submits external proficiency test data directly to ASCLD/LAB, ANAB, and/or A2LA. Please select one of the following statements to ensure your data is handled appropriately.

- This participant's data is intended for submission to ASCLD/LAB, ANAB, and/or A2LA. (Accreditation Release section below must be completed.)
- This participant's data is **not** intended for submission to ASCLD/LAB, ANAB, and/or A2LA.

Have the laboratory's designated individual complete the following steps **only if your laboratory is accredited in this testing/calibration discipline** by one or more of the following Accreditation Bodies.

**Step 1: Provide the applicable Accreditation Certificate Number(s) for your laboratory.**

ANAB Certificate No.   
(Include ASCLD/LAB Certificate here)

A2LA Certificate No.

**Step 2: Complete the Laboratory Identifying Information in its entirety.**

Authorized Contact Person and Title

Laboratory Name

Location (City/State)